May 1963

Agriculture

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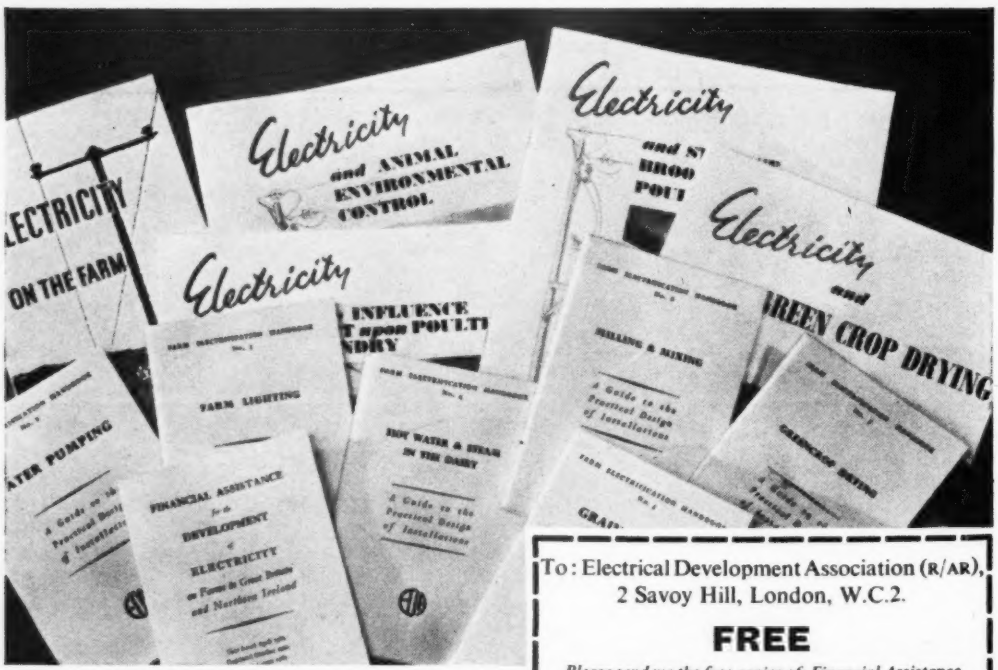

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Agriculture

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Editorial Offices
Ministry of Agriculture, Fisheries and Food
Whitehall Place, London S.W.1. Trafalgar 7711

CONTENTS

SEMERON

controls fat hen in kale

an important new aid to successful kale cultivation

Weeds are one of the main limitations to successful kale growing. Mechanical methods of control are not satisfactory and weed competition frequently causes reduced yields.
Fat hen is by far the most common weed found in kale and in many areas it is considered to be the main factor in preventing the crop reaching its maximum yield. The introduction of Semeron means that fat hen in kale can now be reliably controlled.

semeron is safe

Semeron is completely safe to use. There are no toxic hazards to cattle feeding on crops which have been sprayed.

semeron spraying increases yield

The reliable control of fat hen gives the crop a chance to grow, free from severe weed competition, and greatly increased yields can be obtained. Trials have shown that spraying with Semeron has resulted in increased yields of more than 5 tons per acre.

Essex	Marrowstem	unsprayed	26 tons per acre
		sprayed	31 tons per acre
		increase in yield	5 tons per acre
Pembrokeshire	1,000 head	unsprayed	13 tons per acre
		sprayed	17 tons per acre
		increase in yield	4 tons per acre
Monmouthshire	Marrowstem	unsprayed	8 tons per acre
		sprayed	16 tons per acre
		increase in yield	8 tons per acre
Devon	Marrowstem	unsprayed	14 tons per acre
		sprayed	20 tons per acre
		increase in yield	6 tons per acre

For maximum control and highest yields, spray as soon as possible after the kale has three leaves.
Semeron is approved under the Agricultural Chemicals Approval Scheme.
Semeron—another exclusive product of development by Fisons Pest Control Limited.

SEMERON

Fisons for good farming

FISONS PEST CONTROL

Semeron is a trade mark of J. R. Geigy S.A., Basle, Switzerland

YELLOW PERIL

So may ragwort justly be called. It causes greater loss to our livestock than all other poisonous plants put together—and this mainly by being fed in hay, silage and dried grass. The conservation process leaves the alkaloid poison quite unimpaired and whereas stock will often avoid it in pastures, they accept it readily from the rack.

The yellow-flowered plant, of which there are several species—all poisonous—is very widely spread; every county has it. The seeds, ripening from August onwards, are dispersed by the wind and mechanically in other ways. They can lie dormant in the soil for years. Make no mistake, this weed is a real menace.

The best way with it is to plough and follow up by thorough cultivation (if possible crop the area before putting it back to grass). The second line of attack is by spraying with either MCPA or 2,4-D when the flower-buds are just visible—usually late June or early July in the south. The timing is important. Treatment earlier than this may allow regrowth from the base of the plant; later the setting of the seed may be unaffected.

If you use MCPA the right strength is 24–32 oz of acid equivalent per acre. With 2,4-D (amine), the same; with 2,4-D (ester), 16–24 oz. Newly-sown leys, however, should not be sprayed with these chemicals because of likely damage to the clover.

The important thing is to be aware of the danger that may lie in every lot of hay, dried grass or silage feed and to eliminate it where it starts—in the field.

The 1963 contracts require a higher sugar content in beet

Sugar Beet

Quality or Quantity?

A. C. Owers

THE sugar beet grower has always been paid on a quality basis, with an agreed price per ton for all beet of a standard sugar content and a variation up or down with every 0·1 per cent difference in sugar content. In theory this should have encouraged the production of roots with a high sugar content, but unfortunately it is very much easier to increase root weight than sugar percentage. The operative criterion for the beet crop is the amount of sugar produced per acre, and nearly all factors which lead to higher sugar content result in a reduced root weight. So it is never possible to aim at maximum yield and still produce roots of the highest quality.

Value per acre

The value per acre of a crop of beet is determined, therefore, by the price paid per ton of roots, and this fluctuates with sugar percentage. If the basic price for roots of a given sugar content is high in relation to the price differential for quality, then it is in the farmers' interest to grow a high root yield; conversely, if the emphasis is on quality, then root weight may be sacrificed to some extent at the expense of high sugar content.

The same yield of sugar per acre (50 cwt) is produced from a 13·5 ton crop of roots with a sugar content of 18·5 per cent as from a crop yielding 16·1 tons at 15·5 per cent sugar. Under the terms of last year's beet contract, the former crop would have been worth £96 10*s.* 6*d.* per acre, whereas the latter would have returned £97. In this particular instance, there was little to choose between the two crops on cash value, except that in the latter case the grower had an extra 2½ tons of beet to lift and transport to the factory.

Bearing in mind that it is very much easier to increase root weight by 2½ tons per acre than sugar content by 3 per cent, there was some justification for producing high yields at the expense of high quality.

Basing their arguments on calculations such as that just quoted, growers have been increasing root weights over the years, and there has been a comparable steady decline in sugar content with each increase in yield. Returns to the farmer have increased, but this has accentuated the problems of sugar extraction at the factories, both because of the increased tonnage of beet to be processed, and more particularly because as the sugar content has fallen the extraction rate has declined. So basically, although returns per acre have improved, the final yield of extracted sugar has not shown a comparable rise.

1963 contracts

As from 1963, the financial arrangements in the beet contract have been modified to place greater emphasis on beet quality as opposed to quantity. Instead of 7*s.* 6*d.* per ton being added or subtracted for each variation of 1 per cent in sugar content around 15·5 per cent, the comparable figures are to be 10*s.* per ton and 16·0 per cent. Assuming therefore that the basic price for beet of 16 per cent sugar content in 1963 will be the same as that in 1962, the comparable values for the two crops quoted earlier in this article would be £100 14*s.* 9*d.*, against £95 19*s.* 11*d.* In addition, there will be 2½ tons of beet per acre less to lift and transport to the factory. Undoubtedly this change in Clause 1 of the contract will encourage the production of higher quality roots because of the increased financial encouragement, and this in turn will lead to a higher extraction rate.

Varieties and manuring

It is a pity that, from the growers' point of view, there is no single factor or method of husbandry that will provide the right type of roots for maximum financial return. Conditions also vary so much that no one set of rules, even if faithfully followed, will result in absolute success. It is far easier to plan for high root weight than to produce a well-balanced crop giving maximum sugar per acre from high quality roots of good extractability. There are, however, a number of factors which influence sugar content, and bearing in mind the new terms of the contract, these merit very close attention.

Probably the greatest single factor is the choice of variety, and it is in this connection that future improvements are most likely. In the past we have mainly looked for high yield at the expense of sugar, and breeders have tended to produce the type of seed in greatest demand. With the new emphasis on high sugars, we are likely to see improved varieties within the next year or two that measure up more closely to the requirements of the modified contract.

Seed for the 1963 crop is ordered and delivered, so choice of variety is already made. But there are other aspects of husbandry which can play an important role in producing good yields of high quality roots from this season's crop. In particular, the level of manuring is of major concern and, compared with previous years, there is need for a much more accurate assessment of the amount of nitrogen required; an excess of nitrogen not only fails to produce any further increase in yield, but may reduce sugar content substantially.

Quality or quantity?

From the mass of experimental evidence available on this subject, there would appear to be little justification for applying more than 100 units of nitrogen per acre, except under the most unusual conditions. The need for adequate phosphate, potash and salt is well known, and is provided by most concentrate mixtures recommended for sugar beet. Generally these nutrients are not applied in excess—and have little harmful effect if they are—but nitrogen, because of its marked visual effect on the crop, is so often wasted through over generous application and faulty timing. Some growers withhold part of the nitrogen dressing for use on the crop as a top dressing after singling; but again, all experimental evidence points against this practice, since it encourages top growth and tends to delay maturity.

Drilling dates

This question of maturity will be of considerable importance in the future, for sugar content continues to rise until full maturity is reached, and there is also an increase in extractability. In a twelve-year series of trials at the Norfolk Agricultural Station, early drilling gave much greater yields of sugar, and there is, therefore, ample evidence that the sowing date is of great importance.

In this particular trial series, 'E' and 'N' strains of beet, drilled on two sowing dates a month apart, were lifted throughout the full harvesting period and compared for yield and sugar content. The 'N' strain reached its maximum yield relatively early in the season, whereas the 'E' strain gave progressive increases in sugar yield up to the middle of November.

Under the 1963 contract, with the emphasis on sugar, it will be highly advantageous to concentrate on early-drilled 'N' strains for the early liftings, leaving the slower-maturing 'E' strains for harvesting from mid-season onwards.

With a price differential of 10*s.* per ton for each 1 per cent increase or decrease in sugar content, quite small fluctuations can have a marked

economic effect, and any husbandry practice that will improve sugar content can lead to increased returns without additional cost.

Plant populations

It is an accepted fact that increased plant populations per acre lead to higher sugars, and trials carried out at Sprowston several years ago showed that increasing plant populations from 22,000 to 35,000 per acre resulted in a rise in the sugar content of 0·3–0·5 per cent, irrespective of the type of soil on which the trials were done. Bearing in mind that the national average is somewhere around 22,000 plants per acre, growers who normally finish with 20–25,000 plants per acre can increase their income by ensuring a full braird carefully singled to a stand of something approaching 30,000 plants per acre. Whether increases in plant above 30,000 will lead to even higher sugar contents is a point now under investigation. Lifting large numbers of roots by hand is no longer a problem in these days of mechanical harvesting.

Guard against Yellows

A severe attack of Yellows can, of course, reduce sugar content by up to 1·5 per cent, although more normal figures range from 0·25 to 0·5 per cent. These losses, together with a substantial drop in yield, may be very serious, and all growers are urged to take protective action as soon as they are informed by the factory agriculturists that it is advisable to do so. The use of sprays or granules is now the recommended method of control. Their application is simple and relatively cheap, compared with the losses that may occur if no action is taken.

Finally, there is intense activity among plant breeders to produce improved strains of beet to meet the changed contract conditions. Until these are available—in two to three years time—it is the duty of every grower to take such steps as he can to produce good yields of high quality roots by all means available to him.

Before becoming Director of the Norfolk Agricultural Station, Sprowston, the author of this article, **A. C. Owers, M.A., Dip. Agric.(Cantab.),** was Director of the Ministry's Terrington and Kirton Experimental Husbandry Farms.

D. D. Collyer

The Norfolk County Council is particularly concerned in providing farm buildings for some 705 smallholders throughout the county. Rents range between £3 and £12 per acre

Modern Farm Buildings for Smallholders

LABOUR-SAVING design in buildings is as essential to the economic and efficient running of the small unit as it is to the large farm. The Norfolk County Council has this very much in mind and endeavours to provide a flexible basic building which will not only assist the tenant to obtain the maximum income from his holding, but also readily permit adaptation or expansion if required.

Principles of design

Scattered over an area of some 32,000 acres, embracing soils which range from heavy to light loams, and fen to silts, a standard design of building for erection throughout the county would clearly be impracticable. Therefore, when planning the best type of building for a particular holding, the guiding considerations are: acreage to be served; type and methods of farming practised in the district; siting, with special regard to suitable hard access and availability of mains services; convenience of layout; economy of labour; minimum maintenance; and cost in relation to the rent the holding may command.

In design, the buildings are simple. They are constructed of traditional materials, and have an east-west alignment, reminiscent of the north range of the traditional U set. Wherever possible divisions and partitions within the shell of the main building are readily removable, which not only allows for a quick adjustment of size or position of a compartment to cope with changing needs following fluctuating markets, management methods and the like, but also the removal of obstacles to the free passage of machinery for loading, cleansing, feeding or some other service.

Materials and components

The framework of the main shell of the building is concrete or steel. Height to eaves varies between 9 ft for Portal frames and up to 12 ft for conventional truss construction, providing reasonable room for storage but eliminating the large cold wasted space in the roof, with which pre-war buildings were encumbered.

Infilling between columns for external walls is normally 9 in. brickwork to a height of 6 ft 6 in., with asbestos cladding above. Hollow concrete block walls 9 in. thick have been used at little or no saving in cost compared with brickwork, but the latter is considered better both as to appearance and thermal insulation, plus protection against driving rain. Solid 6 in. concrete block walls to a height of approx. 6 ft 6 in. form walls to internal boxes when these are provided.

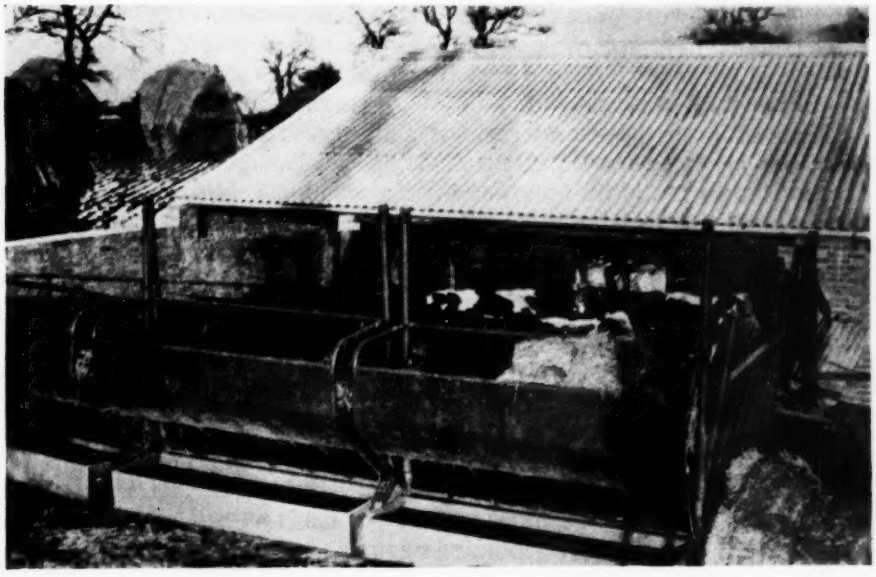
Corrugated asbestos sheeting for roof coverage normally keeps its position as the most economic and serviceable, and now allows for lower pitches than were at one time considered practicable.

Full use is made of fixed translucent roof lights, but wall windows are kept to a minimum, owing to their susceptibility to damage and costly maintenance.

According to the requirements of individual buildings, doors are of timber or corrugated iron on angle-iron framing, with heavy type furniture.

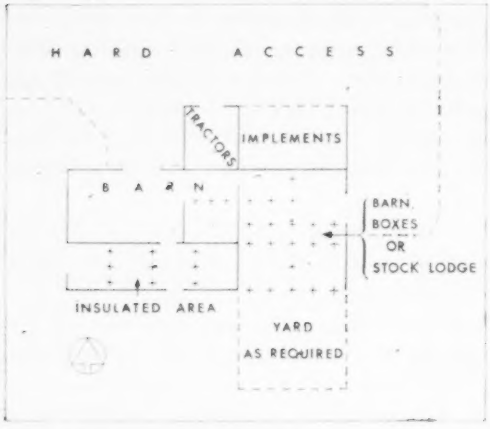
On sites where subsoils are unsuitable for concentrated weight of the stanchions of a framed building, main walls are constructed in traditional 9 in. brickwork with expanded metal between say, every fourth course, the concrete foundations being extended appropriately to spread the load. In the case of some detached or specialist buildings where condensation or insulation is of little importance, full use is also made of timber-framed and corrugated iron cladded buildings.

Movable, combined mangers and hayracks form one side of this open yard.



Basic building for 50–75-acre holdings

Covered stock-yard bays have concrete floors in which 4 in. × 4 in. iron sockets are inserted at intervals of 3 and 4 ft to receive uprights supporting portable divisions. Thereby, given areas can be adapted to provide compartments of variable shapes and sizes, for use in part or whole, for stock, boxes, implement or barn accommodation.



There are double doors at the gable end, with sufficient head room to allow entry of a combine harvester and other implements, and for stock feeding and the mechanical removal of manure.

A departure from the fixed enclosed yard has been developed during the past two years, one side of the open yard being constructed in 9 in. brickwork or hollow concrete blocks to a height of 6 ft and the enclosure completed with movable, combined mangers and hayracks, providing flexibility as to size and shape of yard, ease of feeding, access and removal of manure. This experiment has, however, had a mixed reception with the tenants. Many of them prefer traditional solid walls.

Boxes and portable divisions

Ranged along the southern side of the building (under a lean-to roof to reduce height and eliminate cold roof space) is an insulated area designed to provide one, two or three boxes of varying sizes. Insulation is simple—merely the insertion of land drain tiles, hollow blocks or similar agents in the concrete floor, and fibre glass sandwich lining for the roof. Walls are of solid 9 in. brickwork or cement-rendered concrete blocks.

The floors have receiving sockets, as mentioned before, to allow the number of boxes to be formed according to the tenant's requirements, again by the insertion of portable divisions.

Double doors in the end external wall allow mechanical removal of manure from this insulated section of the building; single doors are provided for access from barn and from outside the main building. Lighting is by translucent roof lights.

Because of the weight of concrete panels and their fractile nature, the Council provides 4 in. × 4 in. oak posts and 1½ in. elm boarded portable divisions in the insulated boxes. The tenant is responsible for all other divisions—timber, bales, corrugated iron, etc.

Barn and implements

Sliding double doors give access to the remainder of the building, which consists of the barn and/or implement accommodation. The floor is of concrete and fixed roof lights admit natural lighting. A 5 ft 6 in. high by 9 ft long stub wall forms a stacking, storage or mixing bay, which can also be adapted for the temporary housing of small livestock.

Buildings on a 50–75-acre arable holding

To meet the need for more buildings with the increase in mechanization, a design has been developed giving extra tractor shed and implement coverage in a lean-to building along the main north wall, at an economic cost per yard super in comparison with the main building.

Drainage and other services

Where practicable, sewage, after passing through the settling chamber, is dispersed by land drains. Rainwater is discharged direct into ditches or soakaways.

Where the existing subsoil is unsuitable for gravel or similar hard surface, roads and approaches of concrete, gravel/asphalt or tarmac are provided.

All electrical wiring is in P.C.P. and sheathed in steel conduit protection below a height of 4 ft 6 in.

A piped mains water supply is of course always connected when available, full use being made of PVC pipes, both underground and within buildings. The piping, wrapped in hair felt, is carried round internal walls some 12 in. below eaves level and is never routed under yards.

Dairy holdings

In traditional dairying areas the implement accommodation is reduced, stock yard coverage increased and a milking parlour, dairy and second yard provided. The milking parlour with six standings, sited and designed for ease of access from outside the building and the covered yard, consists of standard concrete manger, a floor having $1\frac{1}{2}$ in. fall from either wall to the heel of the animal (walls rendered to 4 ft 6 in.) and with removable tubular steel divisions. The dairy has tubular utensil rails set into the walls at pail height. With the elimination of a dunging channel and the ease of removal of divisions and rails, the building can be easily adapted for other purposes.

Special areas

Where fruit and vegetables are the main crop, one large prefabricated type of building has been developed, having portable divisions to form stores or boxes, roof lights and wall windows to serve the packing benches, and double doors admitting lorries for loading. Liberal implement and tractor accommodation is, of course, necessary in these areas.

Specialist buildings

Because of the high cost to the landlord, the tenant is expected to provide his own 'second string' specialist buildings (such as piggeries, poultry houses and store sheds) which might be suitable for one tenant but not necessarily for his successor. They may be sectional or portable, and in some cases obtainable and set in position by a tenant at a cost enabling them to be written off after ten or twelve years' service. By that time new shapes and designs would probably be preferable.

The same principles of design of new buildings apply, as far as is practicable, when carrying out adaptations to existing buildings. Norfolk smallholders are notable individualists and have a pronounced leaning towards insularity. Thus it is not difficult to picture the problems to be solved when adapting a wide range of buildings to be shared between two or more tenants, at the same time making sure that no tenant's building comes close to another tenant's yard!

D. D. Collyer, F.R.I.C.S., F.A.I., is County Land Agent and Valuer to the Norfolk County Council. He formerly served in the West Riding of Yorkshire as an officer in the Ministry's Agricultural Land Service.

Protecting Early Potatoes against Frost

P. N. Harvey
Director, Gleadthorpe E.H.F.

PROFITABLE early potato production is a race to catch the early market. The race is lost if growth is checked by frost damage. Irrigation offers a means of mitigating the worst effects of frost, and is being used increasingly for this purpose by early potato growers in vulnerable districts. Either water can be applied to the soil as a preventive measure before the expected onset of the frost or given as a form of protection during the actual period when the thermometer falls below freezing point.

The first is a more practicable technique for the irrigation equipment and labour resources of a farm as opposed to a specialist horticultural enterprise,

and it depends on the principle that wet, compacted soil is a better conductor of heat than a dry, loose tilth. During the day heat is more readily absorbed by wet soil and can be conducted upwards again to warm the air around the plants as the temperature falls at night. This heat exchange is most effective when bright, sunny days alternate with clear, frosty nights, a quite common pattern of weather during the danger period for killing frosts in late May. The rise in temperature is not very large: the air one foot above wet soil may be 2 degrees F or so warmer than that above loose, dry soil. This may not seem very much, but it is surprising how a relatively small fall in temperature below the critical level at which the first signs of damage are visible makes all the difference between mild damage to the foliage and a severely cut back drop.

Three tons per acre saved

Experience at Gleadthorpe in 1961 demonstrated strikingly the benefits of watering. Most of a small field of Arran Pilot received one inch of water the day before a severe night frost, when the ground minimum temperature recorded on grass fell to 20°F; it should be added that bare ground temperatures are generally a little higher than the corresponding readings on grass. Part of the crop could not be watered until the following day and, as a result, suffered severely from the frost in contrast to the irrigated area where, although the leaves were distorted and tips blackened, most of the foliage remained green. When the crop was harvested in June this area yielded 8 tons to the acre, 3 tons per acre more than the badly checked crop which was not watered before the frost.

The following year there was again a late frost when irrigation on the early potatoes was in progress, but this season (probably because of the cool day temperatures and relatively less evaporation from the surface soil) little difference could be seen between the crop irrigated the day before the frost and that watered later.

Routine

In practice, some measure of protection is given by watering up to four days before the frost. An application of $\frac{1}{3}$ inch every four days over the danger period can be recommended as an insurance covering as much commercial acreage as possible with a limited amount of equipment.

On light soils watering every three days may be advisable, but a look at the surface half inch of soil to see whether it is still moist is the best guide to the amount of water needed. Watering as frequently as this means that the irrigation equipment must be concentrated exclusively on the early potatoes while these applications are in progress, and a lot of labour is needed to keep the pipes moving. But the extra effort is well rewarded if a serious check to a valuable crop can be avoided.

Cornish Cauliflowers

Katharine Johnstone

EARLY in the nineteenth century a steward in a ship plying between Hayle and Bristol noticed the high price of winter cauliflower in Bristol and, being an enterprising man, ventured a trial consignment of local 'broccoli' on his next trip. It sold well, and thus the Cornish cauliflower industry was born.

This old Cornish broccoli was vigorous, hardy and well-flavoured but the curd was yellowish. By the 1920s the English housewife had come to prefer a white-curded winter cauliflower, such as was being sent to the English markets by growers in the Roscoff district of Brittany. Supplies of the seed of these Roscoff broccoli were closely guarded; none was available for sale. But eventually some reached England, following a visit by the late C. H. Oldham. 'Roscoff broccoli', with its pure white dome-shaped curds and blue-green, strongly veined leaves, was first grown at Gulval Experimental Station in 1924. The first commercial seeding of 3 cwt on 2 acres from seed supplied from the Experimental Station was made by Mr. F. Tregoning of Gulval in 1925. The firm of Sutton and Sons (Reading) took up the commercial production and selection of stocks, and Mr. F. R. Horne, while at Seale Hayne College, started a fundamental breeding programme which led to the introduction of the now equally well-known Seale Hayne varieties.

Roscoff types

It is not easy to answer the question 'when is a broccoli Roscoff?' True, the original stocks came from Roscoff, but subsequently there has been some hybridization with other types, particularly the long-leaved Italian types, and much selection to provide continuity of cutting.

The original characters which made the Roscoff type so suitable for West Cornwall remain. They are the pure white, hemispherical head and resistance to Ring Spot fungus. There are some types of winter cauliflower which are more frost-resistant than the Roscoff, but they are susceptible to infection by this fungus, which can cause almost complete defoliation under warm,

Cutting and trimming in the fields at Gulval

humid autumn conditions. Such conditions occur so frequently in Cornwall that only brassica crops resistant to this disease can be grown successfully.

Thus we have the Roscoff type divided into varieties, each of which will be cut over a 4–6 week period between November and May. Some of the leading varieties are: Seale Hayne Extra Early (November-December); Trevean Second (December-January); Seale Hayne A.6 (January); Hilary Seale (February); Trevean Third (February-March); St. David Seale and Trevean Fourth (March); Trevean Fifth (April); and Luscombe's late (May).

Seedbeds

Growers order their seed during the winter, allowing 6–8 oz of seed for every acre to be planted up, and aim at successional cuttings throughout the winter. This takes into account the greatest frost-risk in January and the strongest competition from East Anglia in December. Winter cauliflower in Cornwall today is a farm crop, not one for the intensive market garden. A grass ley will be ploughed and perhaps planted first with early potatoes, for which generous fertilization adequate for both crops is given. Finally, in spring the seedbed is made ready.

Seed sowing now takes place during the third or fourth week of April—later than it used to be. This is partly because the control of flea beetle and cabbage root fly in the seedbed achieved by seed dressings results in a much bigger yield of plantable material; also because machine-planting demands a medium-sized stocky plant. Spraying of the seedbed against aphids and stem weevil is now general.

Planting and cutting

Planting out starts early in July, when normally there is a weather break. It should be completed by the third week of July. One of the most clear-cut of all the experimental results at Rosewarne Experimental Horticulture Station is their proof that planting later than this reduces curd size and yield. Too early planting (June) is likely to result in malformed heads. A usual spacing is 27 inches square, or 8,600 plants per acre.

Before the leaves meet in the rows most cauliflower fields are banked; this is partly to stabilize the plants before the onslaught of winter gales, to align them where tractors are to be driven into the field and to assist water run-off.

Careful packing makes for safe transit

Also, as a Cornishman might say, 'it is a pretty thing to cover up chickweed'. Fertilizer may be applied at this time if none was given at planting.

The time for cutting varies considerably from season to season; the old tradition was to start on Gulval Feast Day (November 14th). Cutting is the most labour-consuming of the processes involved and admits of only limited mechanization.

Men walk the fields cutting heads which are ready for market with a butcher's knife. A horizontal cut is made, leaving sufficient green wrapper leaves around the curd to protect it during transit. The head is then tossed over in the cutter's left hand so that he can trim down the wrapper leaves to about 5 inches from the curd. The number of times the field is gone over depends on the season but is often 6 or 8 times, once weekly except at the peak when twice-a-week is justified. The old 'wickers' for carrying out the heads have largely been replaced by bins or pallets carted into the fields on tractors.

Dispatch to market

Some growers tip and pack their cauliflower on a piece of grass near the field; others take it into a Dutch barn. Before being put in the 'Roscoff broccoli crates' which are universally used, the heads have to be graded for size and quality. The size grades are designated according to the number packed into the standard crate: 12, 16, 24 and 30 in decreasing size sequence. Discoloured or rough heads may be sent as seconds should markets be short. If not, they are slashed down in the field. The curds face inwards, protected by the trimmed leaves, with the butts wedged between the side slats of the crate.

Although this makes for safe transit, some growers are experimenting with containers in which their produce can be displayed rather than concealed. Consignments are sent all over England and to Scotland. Until the 1950s virtually all cauliflower travelled by rail, and many special trains were run. Then road transport, with its speedy door-to-door service, became so popular that by 1961–62 well over half the crop was being marketed by road. The introduction of express freight services by the railways in 1962–63 may see a reversal of this trend.

Acreage steadily building up

At the present time some 7,500 acres of winter cauliflower are grown in Cornwall, yielding 40,000 to 45,000 tons (nearly 2 million crates) in a favourable season at an estimated gross value of £1½ million. The acreage has been building up steadily over the last few years after a period in the doldrums in the early post-war years. Then, deterioration in quality (due to the inferior stocks of seed which were the legacy of war-time difficulties), brought both reputation and profits low. The introduction of the Trevean and some new Seale Hayne varieties changed the picture, and today many farmers regard winter cauliflower as an extremely useful cash crop.

Investigations by the Agricultural Economics Department of Exeter University reveal a margin around £60 per acre in a reasonably good year. Of the gross return, approximately one-third is absorbed by production costs and one-third by transport and marketing costs.

Unfortunately, the attractive margins often secured are by no means safe or certain. They largely depend on the barometric depression or warm front which is so apt to cling so affectionately to the Atlantic, extending its benign influence to the south-west peninsula; but if an Arctic anticyclone intrudes only a short distance westwards, then all is lost.

But this is a rare occurrence. Normally the national markets are well-supplied with Cornish cauliflower throughout the winter and early spring, and in January and February virtually all the English-grown cauliflower is Cornish. Quality reaches its peak of perfection in March; at that time especially the best heads can hold their own against all comers.

Miss Katharine H. Johnstone, M.A., Ph. D., is the Senior Horticultural Advisory Officer in the National Agricultural Advisory Service in Cornwall.

Veterinary Laboratory Promotion

Mr. H. I. Field, M.Sc., M.R.C.V.S., succeeds Dr. A. W. Stableforth, C.B., as Director of the Ministry's Veterinary Laboratories and Veterinary Investigation Service on 3rd May.

Dr. Stableforth, who has been Director since 1950, is retiring to take up a post with FAO.

Starvation in New-born Pigs

The high mortality among young pigs is costing the industry an estimated £7 million a year

High among the causes is starvation suggests

B. L. Edwards

Two million pigs die before the age of weaning in Britain every year. There are no statistics on which to base an estimate which would relate to the world as a whole, but there is no reason to suppose that these losses are any lower in other countries. Every expert recognizes that this is an urgent problem, requiring attention if productivity is to be increased. Many years ago an American agriculturist pointed out that the loss of one piglet represents the loss of 1 cwt of sow and weaner meal. The total immediate financial loss to the British pig industry from deaths in unweaned pigs is certainly not less than £7 m. per year.

These facts are readily overlooked because most piglet deaths occur one or two at a time within a few days of farrowing, and in many cases crushing is a convenient explanation. In a survey carried out by the Veterinary Investigation Service a few years ago a representative sample of dead piglets revealed that many are not injured severely enough by crushing to account for death, but rather that starvation is very common. A strong consensus of opinion holds that *healthy* piglets would not be injured, and that starvation is a major cause of sluggishness.

Causes of starvation

The causes of starvation can be divided between those in the piglet and those in the sow, although their interrelation is such that in many cases a vicious circle is set up. Some piglets may lack the vitality to suck from the moment they are born. This may be due to hereditary defects, unsuitable

nutrition of the sow during pregnancy, or other disturbances of maternal health. Other piglets, although full of vitality at birth, may be smaller than their litter mates and unable to compete with them on equal terms, while entire litters may have their activity brought to a standstill by excessive cold in the farrowing pen. Specific infection may prevent new-born pigs from sucking.

Shortage of milk or, what is more important, of colostrum, may result from disease, malnutrition or genetic defect in the sow. Functional inactivity or underactivity of the hindmost quarters of the udder may be important, as may mastitis affecting one or more quarters.

Effects of starvation

If a pig of more than five days old, or for that matter the young of any age in other species including Man, goes without its normal diet for a day or so, there will be discomfort, unrest, slight loss of weight and possibly some serious complications which it may be difficult to correct. Obviously such ill-treatment should be avoided with any young animal. But in new-born pigs under farming conditions, unless great care is taken, starvation will invariably cause death. Until about six years ago this was attributed to the small size of the piglet at birth—less than one-hundredth of the adult weight, as compared with one-twentieth in the case of a new-born baby or one-fifteenth in the case of new-born lambs and calves. It was also known that, like the calf, the lamb and the foal, the piglet is dependent on colostrum for antibodies to protect it against infection.

Research carried out over twelve years in America and confirmed in this country, showed that the sugar-producing reserves in new-born pigs were very inadequate, and that under experimental conditions piglets provided with glucose survived longer than those with water alone. It was also shown that while piglets starving at 59°F survived for little more than a day, those in an environment at 88°F lived for three and a half days. Piglets starved from ten days of age onwards lived for three weeks.

In these experiments the piglets showed symptoms of sugar shortage such as shivering, frothing at the mouth, and lying on their sides and moving their legs as though riding a bicycle. But in the field treatment with sugar is not easy, and results have been disappointing. Also while fading is a common sign in cases of starvation, symptoms of sugar shortage are not often reported by pig farmers. These facts suggest that while sugar shortage is part of the story it is not the whole of it.

For some curious reason these research workers made detailed analyses and reported results on almost every major component of the blood serum of new-born pigs except the protein. Towards the end of these studies thirteen years ago some Scandinavian workers carried out analyses showing the serum protein levels of new-born pigs to be only one-third to one-half of the levels found in older pigs, but the importance of this was overlooked, even after these results were repeated several times by other research workers. Routine post-mortem examinations made as part of the Survey on Pig Diseases by the Veterinary Investigation Service found a condition of dropsy, or oedema, to be very common and related to starvation. Careful consideration of the function of serum proteins in animals suggested that the low level of serum protein in new-born pigs might be expected to make oedema a common finding.

Like most lines of research, each new discovery raises fresh questions, and we are far from knowing the whole explanation of how unborn piglets manage with less than half the serum protein level found in the foetuses of other species. Nevertheless, it is clear that the tendency to become dropsical passes off by the age of one week or so in normal pigs, and that this is related to a normal intake of colostrum. During the first twenty-four hours of life proteins pass with very little digestion from the intestine to the blood stream and the serum protein level is doubled in the process.

Under conditions where piglets are deprived of colostrum, survival is quite possible if they are insulated in special cages and provided with a special sterile diet. After a week or so the young animal may be able to manufacture some of the components of the serum proteins, but this is too late on the ordinary farm.

Substitutes for colostrum

Hand-rearing of new-born pigs is sometimes successful but the outcome is often uncertain. Success depends on the devotion of the farmer or pigman and on the nature of the substitute used. Work in America and Scandinavia has shown that cow's colostrum may be used. This should be given warm and clean at the rate of two tablespoonfuls every hour, or as often as possible until the piglet is one day old. It should be encouraged to take this from a shallow pan as soon as practicable, and benefit accrues if bovine colostrum continues to be given until four days old. From then onwards a commercial balanced sow-milk substitute may be used until ten days of age, when the digestion of the piglet becomes more robust.

In the future it may be possible to develop a colostrum substitute using serum proteins derived from slaughtered adult pigs. Such serum proteins have been fed to new-born pigs with apparent advantage in experiments, but there are some practical difficulties. Once these are overcome such a food would have the advantage of containing useful protective antibodies—deficient in bovine colostrum.

Management of sow and litter

Hand rearing or supplementing the diet of new-born pigs unable to obtain enough colostrum from the sow is probably a practicable proposition for the small farmer, provided he can obtain surplus bovine colostrum in a fresh condition when it is needed. On the larger farm the split litter system may be desirable for all litters of more than eight piglets. On this system the litter is split into two groups, one of big piglets and the other of the rest. 'Port watch' have access to the sow for one hour and 'starboard watch' for the next hour, and so on. Provided this is allied with careful supervision of farrowing, good farrowing pens, and first-class management including individual feeding with access to pasture in pregnancy, losses in the first week of life may be more than halved.

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Bringing Back the Acres

Sand and Gravel

W. Morley Davies

AMONG the extractive mineral industries, sand and gravel stands second in size, as judged by the area of land affected. But, whereas at least 95 per cent of opencast coal and ironstone land is returned to farming, only 50 per cent is recovered from sand and gravel. The upsurge in building during the last twenty years is largely responsible for this enormous demand.

From river, valley and hillside

It is the gravel beds in the alluvial valleys of several of our main rivers which supply about half of these products. The rest comes from dry deposits occurring as upland river terraces, as glacial gravels or from the older geological formations such as the Bunter Pebble Beds. Sand may be quarried alone. Workings in the river deposits, as in the valleys of the Thames, Trent and Lee, usually leave a lake or wet pit, whereas those in upland deposits normally leave a dry pit. Both dry and wet pits can be reclaimed for agricultural use, but obviously present quite different problems.

Before 1948 operators had no legal obligation to fill and restore. But since then planning authorities can, where it is reasonable to do so and where filling materials are available, make filling-in a condition of their consent to work a site. This will probably specify that the soil cover must be stripped, stacked and later restored. But where the soil is thin it may not be possible to separate it from the underlying subsoil or overburden, and they will become mixed. With light materials this does not matter very much; a skilful farmer can soon put the fertility right. Should, however, the underlying materials be of a heavy nature (e.g., clay or a clay-loam), then it is essential that they be stripped, stored and replaced separately.

Although the purpose of this article is to deal principally with restoration and growing of crops, it must not be overlooked that there may be other uses for worked-out gravel pits, e.g., as in Middlesex, building sites or playing fields. Indeed, close to built-up areas, cropping with cereals may merely be an invitation to sparrows! Unrestored pits may also become a

A wet pit at Ranskill, Notts, after the extraction of gravel

source of pleasure to anglers and boatmen, especially in districts where there is little natural water.

Dry and wet pits

Filling-in dry pits presents no problem. It requires only a reasonable depth of material, 24 inches or so, to lie on the floor of the pit to provide a suitable medium in which to cultivate, to provide root space for crops and drainage. But there is the possibility of soil erosion if the layer placed on the rock is too thin. Near towns dry pits may be at a premium for the deposit of household and other refuse. Being rich in organic matter, town refuse quickly decomposes, and even without fertilizer is capable of supporting quite good agricultural crops. Its main drawback is the presence of broken glass, which usually precludes growing potatoes on account of danger to pickers' hands.

Wet pits are a much more difficult problem. The water is often deep and they require a lot of filling material. In the vicinity of large urban areas there are usually limited supplies of rubble available, but in other parts of the country there may be nothing suitable. Here wet pits may remain unfilled for years. Great care is necessary to ensure that no toxic or deleterious materials are deposited in wet pits which could in any way pollute the local water supplies. For this reason it is not generally permissible for putrescent household refuse to be used. Controlled experimental tipping of such material in a few pits in the West London area recently has attracted a good deal of interest. Such tipping may be direct into the water, in which case special provision must be made to eliminate objectionable odours arising from the fermentation into dry basins from which the water has been pumped.

The coincidence that many electric power stations producing pulverized fuel ash have been sited in gravel-producing river valleys has opened up great opportunities for restoration. This is the case in the Trent, Severn and Lee valleys, among others. A modern power station is producing, as a largely unwanted by-product, a million tons of pulverized fuel ash a year. This material is ideal for filling pits, particularly if it is covered with sufficient soil to make a return to agriculture possible and profitable.

The silt from a gravel washing plant can sometimes be used as a filling agent, and in cases where this has been done good crops have been grown on it.

Farming restored pits

Given a good soil cover, and provided the water-table is at a reasonable level below the surface, no serious difficulties should arise. In other cases where very indifferent materials (such as subsoil) are the only covers available, special treatment must be given if even reasonable cropping results are to be obtained. Even so, it may be some years before crops begin to yield an economic return. An exception is decaying household refuse, where experience has shown that a soil cover is not necessary and fertilizers can be dispensed with during the first few years. In all cases except the last-mentioned, grass is probably the best crop to start with. If properly treated its bushy roots will add organic matter and start building up a crumb structure desirable in all surface soils.

It must be emphasized that every restored site needs individual consideration, but bearing this point in mind it is possible to indicate certain broad principles. Permeability and drainage must be adequate to remove surplus water and a graded surface is needed to avoid ponding in wet weather. Cultivations must be adequate to produce a tilth appropriately fine for the crop being grown. Fertilizers must be used in relatively large quantities. If organics such as farmyard manure, spent composts, etc., are available, they should be applied especially where the soil is thin. Care should be taken to see that no sticky unkind subsoil is brought to the top by cultivation. In such circumstances surface cultivations may at first have to be shallow, deepening them only gradually each year.

At an early stage the farmer will be well advised to get in touch with his local N.A.A.S. officer who will advise him on cropping and stocking. Lime may be necessary and the amount should be determined by analysis; this will also indicate what fertilizers are necessary to suit the proposed crop.

Grass again

For grassland, good seeds mixtures are necessary, and they must be suitable for the intended use to be made of the land. The initial seeding could be of short duration and made with or without a nurse crop such as rape. After two years the land could be reseeded with a longer-term mixture.

A field at Ranskill after restoration

The following general mixtures are given as examples and may be modified to suit local circumstances:

(*a*) *Two-year ley**	*lb per acre*	(*b*) *Long-duration ley*	*lb per acre*
S.22 Italian ryegrass	3	S.22 Italian ryegrass	4
S.24 Perennial ryegrass	8	Commercial perennial ryegrass	8
S.37 Cocksfoot	8	S.23 Perennial ryegrass	8
Broad red clover	2	Danish cocksfoot	3
Late-flowering red clover	2	S.143 Cocksfoot	3
S.100 White clover	1	Late-flowering red clover	2
		S.100 White clover	1
		Kentish wild white clover	½
	24		29½

*If this sward is particularly well managed it may be carried on for a third or even a fourth year, but if, as is likely, it soon shows signs of deterioration, it should be replaced.

The initial seeding should receive in the seedbed, per acre: 30 units nitrogen (N) or 1½ cwt sulphate of ammonia, 90 units phosphate (P_2O_5) or 5 cwt superphosphate, 90 units potash (K_2O) or 1½ cwt muriate of potash, or the appropriate equivalent as 5 cwt of a 6 : 15 : 15 compound.

The poorer the material at the surface the more generous the manuring should be. Even twice the quantity could be applied if there is much subsoil material in the top. After the nurse crop has been grazed off, a dressing of 10 cwt per acre basic slag should be applied. In the following spring and in subsequent years a dressing such as the following may be given, per acre: 60 units nitrogen (N) or 3 cwt sulphate of ammonia, 30 units phosphate (P_2O_5) or 2 cwt superphosphate, 30 units potash (K_2O) or ½ cwt muriate of potash, or 3 cwt of a 20 : 10 : 10 compound could be applied. For the more permanent grass, the dressings should be similar but modified to allow for increasing fertility as time goes on. Basic slag is advisable every third year.

Job completed. Five acres gravelly sand site at Hoddesdon, Herts, ready for farming again

Where grazing is possible sheep are preferable until a strong sole of grass is established. If cattle are used it is important to avoid poaching in wet weather. If grazing is not possible, hay or silage will have to be taken. In no case should thick grass be allowed to accumulate, otherwise the pasture will deteriorate quickly.

Many successes

Arable farming has been quite successful on a number of sites, but since much of the early period following restoration should be spent in building up fertility, there is no doubt that grass, for the first two years at least, is the best crop. When the surface consists of a deep layer of rotted domestic refuse almost any crop, with the exception of potatoes, may be grown. Cereals, mustard, grass, even sugar beet, have all been tried with success. But where arable crops are to be grown on a poorer surface material, a full fertilizer treatment must be given. It is hardly possible here to recommend treatments to cover all possibilities, but as a general guide it is safe to apply at least 50–100 per cent in excess of the amounts which would be used in normal practice.

Many examples of successful restoration have been brought to my notice, but relatively few of them have had the wide publicity they deserve. As might be expected, there are more successful instances following dry workings than wet, for reclamation of dry working can be carried out progressively and the land need not be out of cultivation for long. There are some instances where upland sites have been improved because, when the gravel was removed, the replaced soil was at a lower level. It was, therefore, nearer the water table and the sites were less liable to drought than in their more elevated natural positions.

Wet pits present far greater difficulties, nevertheless many successes have been reported. In river valleys where filling material such as rubble or power station ash are available, animals or crops are once again in possession. There seems little doubt that very many more of the wet pits, particularly in the Midlands, will soon be returning to productive use.

Pests of Brassica Seed Crops

Blossom Beetles

Cabbage Seed Weevils

Cabbage Stem Weevils

Arthur Winfield

Of the pests which take such a heavy toll of brassica seed crops every year, the three which in my opinion are the most serious and widespread are blossom beetles, cabbage seed weevils, and cabbage stem weevils.

Growers are often undecided whether a chemical control programme is worth while, particularly on the overwintered crops, coleseed, turnip and swede-seed, kale, Brussels sprouts and broccoli. This is probably because spraying against these three pests must be done in spring, just before flowering begins. On the taller crops ground machinery is often out of the question, and aerial treatment is both costly and perhaps difficult to justify if the crop occupies only a small area.

Three to watch out for

Blossom beetles are of a metallic greeny-black colour, about one-eighth inch long and are most numerous in the crop just before and during flowering. The two weevils may be less familiar, perhaps because there are seldom as many of them as blossom beetles. Seed weevils are of a lead-grey colour and are usually found with blossom beetles on the upper parts of the plant. Stem weevils are more mealy-grey and are not found so commonly on the flowering parts of seed crops. Both weevils are one-tenth inch long.

The three insects have similar life cycles but differ in their behaviour and in the damage which they do. The adults overwinter in sheltered places—copses, dyke-sides, farmyard litter, beneath loose tree bark, and in the soil near the previous year's seed crops. They are active fliers and invade brassica seed crops as temperatures rise in spring. There is only one generation a year.

Stem weevils lay their eggs in the leaf-stalks from about the sixth or seventh broad-leaf stage onwards, and the grubs tunnel into the stems during May

and June. The lower leaves fall prematurely and the plants lose vigour, but the effect of stem weevil on seed yield is not known. Nevertheless, I suspect that heavy infestations of larvae can cause serious losses.

Blossom beetles eat tiny slits in the bases of the small flower-buds and lay their eggs inside. Both the adults and their larvae also damage other buds and flower parts, and these damaged buds wither and die, so reducing the number of pods set. Occasionally, a distorted or stunted pod forms where a flower bud was only slightly damaged.

Seed weevils lay their eggs in the young pods, and each grub eats several seeds during its development. The number of seeds eaten by each larva depends mainly on seed size, which varies with the type of brassica and with season. When they are fully fed the larvae bore exit holes in the pod walls, fall to the ground and pupate. These exit holes in the pods are very easy to see during June and July.

Crops attacked

Although stem weevils readily attack the overwintered crops, they are usually a more serious problem on the spring-sown brassicas. Of the spring-sown crops, white mustard is usually less affected than the brown-seeded variety Trowse (*Brassica juncea*), although recent work on thinner, shorter-stemmed varieties of white mustard has shown that they are more prone to attack than the older hollow-stemmed variety.

Blossom beetles attack all brassica seed crops. On the overwintered brassicas they are usually most serious on crops with a long flowering period, and less serious on crops which produce buds, flowers and pods quickly.

Seed weevils attack all spring-sown and overwintering brassicas with the exception of white mustard (*Sinapis alba*). For all practical purposes this crop is immune to attack by seed weevil grubs, although the adults are often found in the crop.

Chemical control

The flea beetle seed dressing may give a partial control of stem weevils, especially if it is used at high rates with kerosene as the sticker. A full insecticide programme against flea beetles and blossom beetles usually gives an adequate control of stem weevil, and a special spray against this pest is rarely necessary.

The chemical control of blossom beetles and seed weevils can be considered as one continuous operation for most brassica seed crops, with the exception of white mustard. On this crop blossom beetles are controlled with two or three applications of DDT at the timings shown in the table on p. 231. If stem weevil is a problem the first spray (green-bud stage) may be dieldrin, since DDT will not control either of the two kinds of weevil.

For blossom beetles and seed weevils on other brassicas, two or three carefully timed applications of dieldrin or gamma-BHC, should give a satisfactory control. Give the first treatment as soon as the first flower-buds are seen (green-bud stage), and follow it a week or ten days later with another. On spring-sown crops this second treatment will usually coincide with the appearance of the first yellow buds. These two treatments control the damage by blossom beetle adults and grubs, and the second treatment will give some control of seed weevil.

A complete control of seed weevil can rarely be obtained unless a third treatment is applied, five or six days after the first flowers have opened. This is obviously an undesirable practice because bees and other beneficial insects will be killed. As a compromise it is best to delay the third treatment until just before any flowers are actually open. This will give a good control of seed weevil, and be less harmful to bees and parasites and predators of the pests than treatment of a flowering crop.

Variations

There is no universal relationship between the number of adult pests present in the crop in spring and subsequent seed losses. It is therefore very difficult to give precise recommendations for treatment which will cover all crops and all seasons. However, crops with low numbers of plants per acre will usually withstand higher populations of insects on individual plants than will denser crops in which the individual plants are smaller. On overwintered crops (except Brussels sprouts and broccoli) treatment is usually worth while if there are more than twenty blossom beetles and two seed weevils per plant at any time during April or May. The earlier the level of attack is determined, the more timely will be the treatment.

There are usually fewer plants per acre in Brussels sprouts and broccoli seed crops than on the other overwintered brassicas, and 30–50 blossom beetles and 2–4 seed weevils per plant usually justify treatment during April. Mustard and other spring-sown crops, which are always grown at higher plant populations, should be treated if 5 blossom beetles are counted on each plant during the second or third weeks in May. Trowse mustard, and other susceptible spring-sown brassicas should be treated for seed weevils if there is a count of one or more per plant during the last fortnight in May or the first week in June.

Two treatments

Early drilling is of great value both for spring-sown and overwintered crops, but frost damage is a risk if the latter get too forward in autumn. There is some evidence, both from this country and from the Continent, that vigorous plants can often withstand considerable pest damage and make a partial recovery. For instance, it is possible that the plants may compensate to some extent for buds destroyed by blossom beetles, by producing pods from buds which would not otherwise have developed. I do not think that the plants can compensate for damage by the two weevils. Growers have therefore usually to make up their minds to treat or not to treat. In most years two treatments are economically worth while and should repay their cost on spring-sown crops. This assumes that the treatments are correctly timed, correctly applied, and not done just before or during unfavourable weather.

During April and May the population of adult blossom beetles builds up in individual brassica seed crops through constant immigration. In early spring this immigration is from the beetle's winter quarters, but later there is a good deal of movement from crop to crop. This may give a false impression that the earlier treatments have been ineffective, particularly on mustard and other spring-sown crops. The green-bud stage spray should hold the build-up for 7–10 days, by which time the crop is ready for the second spray.

THE MAIN PESTS OF BRASSICA SEED CROPS

Pest	*Nature of Damage*	*Time of Damage*	*Crops Attacked*	*Control (ask local N.A.A.S. if in doubt)*
Cabbage-stem-flea beatle	Larvae tunnel in leaf-stalks and stems. Adults not important	From autumn through to spring	Coleseed and other overwintering crops	Spray of gamma-BHC in October or November. Isolation from previous year's crop.
Flea beetles	Adults eat holes in and destroy seed leaves. Larvae not important	April and May	All brassicas. Damage worst in dry seasons on spring-sown crops	Combined gamma-BHC/fungicide seed dressing. If attack prolonged or season very dry, supplement with spray or dust of DDT, gamma-BHC or dieldrin.
Stem weevils	Larvae tunnel in leaf-stalks and stems. Adults not important	Late April, May and June	All brassicas, but Old English white mustard is less susceptible	Flea beetle seed dressing gives some control. Dieldrin spray at seven broad-leaf stage (spring-sown crops) or in early May (later-flowering overwintered crops).
Blossom beetles	Adults and larvae destroy flower-buds	April, May and June	All brassicas	Three treatments of DDT, dieldrin or gamma-BHC at green-bud, and first yellow-bud stages and just before flowers open. High or low volume sprays or micronized dusts. Two treatments are minimum for success.
Seed weevils	Larvae destroy seeds in developing pods. (Usually one larva per pod.) Adults not important	June and July	All brassicas, but white mustard not attacked	See text.
Brassica pod midge	Several small white larvae inside each pod. Pods ripen prematurely and shed seed	June and July	All brassicas, but overwintered crops worst affected. Always associated with seed weevil	Control of seed weevil controls the midge.
Cabbage aphids	Colonies of mealy-grey aphids cover leaves and branches	July and August	All brassicas	Effect on yield unknown. Control usually impracticable, except by aircraft.
White butterflies	Caterpillars eat leaves	June and July	All brassicas	Rarely serious enough on seed crops to justify treatment.

Treatment of tall crops with tractor-drawn spraying machines inevitably results in some damage to the crop. This can be minimized by fitting large-diameter land wheels, with narrow treads, or by using special high clearance machines. Overwintered brassica seed crops and very tall spring-sown crops cannot usually be treated with ground machines. The economics and practicability of aerial treatment are usually the deciding factors in such cases. I must emphasize, however, that growers should regularly and carefully examine their seed crops in spring and early summer. In this way the pests can be detected early enough to allow observations to be made on their build-up and for accurate decisions to be taken about timing of treatment.

Recent work by J. and J. Colman Ltd. of Norwich has shown that spray volumes of 30–100 gallons per acre are usually satisfactory on mustard. Also the new micronized dust insecticides (4–5 lb per acre) seem to be fairly effective. Although this latter method is quicker and much simpler than spraying, the material is at present more expensive than the equivalent liquid formulation.

It is important to adjust the spray boom (for liquid sprays) to clear the top of the crop by 12–18 inches, and to use fairly low tank pressures with fan-type nozzles (30–50 lb per sq. inch). Higher pressures or insufficient clearance result in much spray drift and loss of insecticidal effect. If possible, spraying should be done only on calm, dry days.

All insecticides, including DDT, are lethal to flying bees, and if a flowering crop has to be treated the early morning or evening are the best times; fewer bees will then be working the crop than during the middle of the day. A complete spray programme against blossom beetles and seed weevils almost certainly affects their natural enemies, and may have undesirable long-term side-effects. However, if the recommendations outlined in this article are carefully followed, better yields of higher quality seed should be obtained, with the least serious side-effects on beneficial insects.

The author, **Arthur L. Winfield, B.Sc., Dip.Agric.Zool., M.I.Biol.**, a Lancastrian by birth, has special interests in soil, plant mites and eelworms, and the side-effects of insecticides on fauna other than pests. He joined the N.A.A.S. in 1957 and is at present Advisory Entomologist at Kirton, Lincs.

SYDNEY
MOORHOUSE

PONIES as a Sideline on Hill Farms

NEARLY eight hundred years ago, when Archbishop Baldwin of Canterbury carried out his famous preaching crusade through Wales, one of his colleagues is said to have remarked that the mountains were 'full of ponies'. This no longer holds true, but there are still many herds of Welsh ponies on the hills of the Principality, and a number of them provide the animals that serve as foundations for the breeding pony studs.

Our other native breeds—the Fell, Dales, Highland, Exmoor, and the rest—also have their protagonists, and unquestionably the present-day interest in riding, trekking, and other equestrian activities, particularly among young people, has greatly stimulated breeding with the old native strains.

Indeed, while horse breeding has declined to some extent in recent years, (except, of course, for bloodstock, which is a highly specialized branch), more ponies are being raised than for some considerable time. Some hill farmers are finding that a herd of ponies is a profitable and entirely economical addition to upland cattle and sheep. Most of the work can be carried out by the farmer's wife, daughter, or a girl employee.

Welsh breeds

A visit to any agricultural show where children's riding ponies are on view shows how much influence the two Welsh breeds, the Welsh and the Welsh Mountain, have had in the production of good stock. Since the parent

Welsh mountain ponies from the Coed Coch herd

body, the Welsh Pony and Cob Society, formed its own Stud Book in 1901, over 10,000 mares and 2,000 stallions have been registered.

For many years there was little or no control over breeding, but in the autumn there were big round-ups. The most useful animals were kept for stock and the rest sent to the fairs where there was a big demand, especially for the stronger type of ponies for use in the mines.

Today, breeding is much more selective, and the Welsh Pony and Cob Society offers premiums for stallion owners who let their animals run with mares from May to August each year. The Society appoints inspectors, who make a tour of the different areas, select the stallions to receive the premiums, and then each chosen stallion is allocated its own run.

There are farm families who have specialized in the breeding of ponies for many generations. One of the most famous herds of Welsh Mountain ponies is the Criban, kept by Mr. H. Llewellyn Richards on the slopes of the Brecon hills at Bwlch. This herd is generally believed to have had its origin in ponies used by a certain Richard ap Howell for both shepherding and hunting in the seventeenth century. Today, Criban blood is in great demand not only in this country, but also on the other side of the Atlantic.

In North Wales, the most famous is the Coed Coch stud, founded by Miss M. Brodrick, the present owner, in 1924 and built up from the top blood lines of the breed. Coed Coch ponies are to be found in all parts of these islands, as well as North America, South Africa and the Scandinavian countries. In September, 1959, when ill-health compelled the owner to cut down the size of the herd, one of the mares, 'Coed Coch Symwl' was sold to Lord Kenyon for 1,150 guineas—the highest price for one of the breed paid in a British auction ring. The Coed Coch herd still numbers nearly 100 ponies, which run with a breeding flock of 1,000 Welsh Mountain ewes and some 200 Welsh Black cattle on the Denbighshire hills above Abergele.

Today the majority of herds of Welsh Mountain and other ponies run with hill cattle and sheep, but there was a time when Welsh shepherds

looked upon them as a serious competitor to the interests of sheep-breeding. It was then that the number of ponies on the hills declined.

Discussing this with some of the old breeders, I have been reminded that concurrent with the decrease in ponies came the spread of bracken, and that when the hills were well stocked with ponies their sharp hoofs seemed to have the effect of cutting the stems and so keeping it under control.

Fell and Dales

On the hills of Cumberland, Northumberland, and adjacent counties, the native Fell and Dales ponies have their supporters. Doubtless both breeds have a common ancestry, yet today they are regarded as quite distinct, and each has its parent governing body—the Fell Pony Society for the one and the Dales Pony Improvement Society for the other.

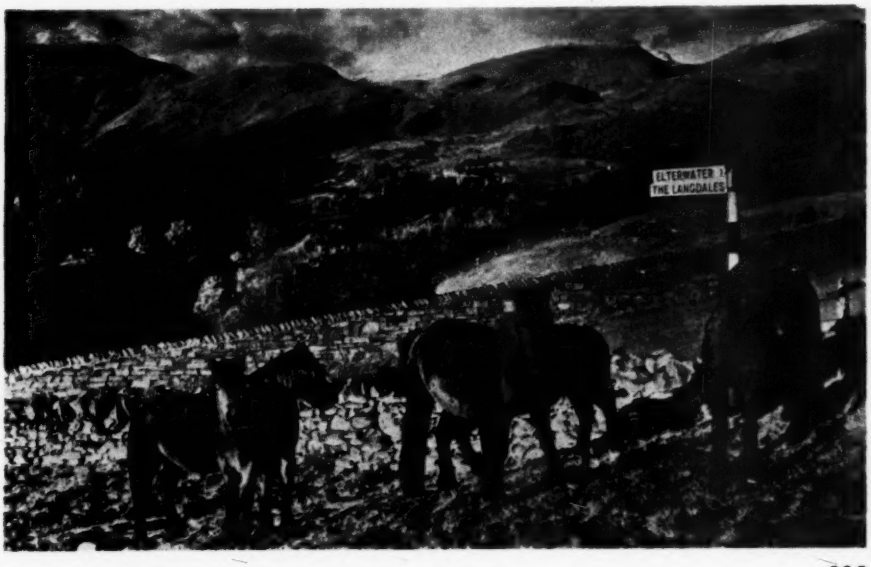
The Dales pony, which is usually found on the eastern side of the Pennines, is the larger of the two. The Stud Book allows animals up to the height of 14 hands 2 in. The Fell should not exceed 14 hands, and is usually around 13 hands 2 in.

Time was when both breeds were used in connection with the various mining enterprises carried out in the North Country, the stout little hill ponies being capable of carrying loads of as much as 16 stones' weight along the mountain and moorland tracks and passes which led from the mining areas to the coastal ports. Nowadays their demand (and quite a good one) is for use as riding ponies. Numbers have been sent abroad to Pakistan, North America and other parts of the world in the past ten years.

As in the case of the Welsh breeds, many of the finest ponies have been bred and reared on the upland farms by enthusiasts who have run a herd along with their normal stock of cattle and sheep.

On the hills above Ireby, in Cumberland, and where the renowned John Peel rode his stout pony over a century ago, are two of the most noted herds of Fells—the Guards and the Waverhead. The first, from which stock has

Fell ponies on Oxenfell, by the Ambleside—Coniston road



gone to Pakistan, belongs to Mr. R. Little and is run along with his 100 head of cattle and flock of 200 breeding ewes. The Guards herd has supplied the champion stallion at the Fell Pony Society's spring show five times in the last nine years. Mr. J. Bell, the owner of the Waverhead herd, has Shorthorn-type milkers and a few Galloway sucklers along with his ponies.

The Secretary of the breed society, Miss P. Crossland, is another who combines Fell pony breeding with farming near Windermere. And in Northumberland Mrs. G. F. S. Newall has her Dene herd at Todridge Farm, some 700 feet above the Tyne valley at Great Whittingham, along with a herd of Highland and Highland cross cattle and a flock of Border Leicester x Blackface ewes. Recently, some of Mrs. Newall's ponies were sent to Canada.

One of the oldest and most noted of Dales pony herds is that kept by Mr. Tom Emerson, who runs his ponies with 80 to 100 head of cattle and 100 sheep on his 200-acre farm at Wheatside, Bildershaw, near West Auckland. Similarly, the President of the Dales Pony Improvement Society, Mr. J. W. Dalton, of Snowhope Close, Eastgate, near Bishop Auckland, has his herd running with about 50 Shorthorn cattle and 300 to 400 sheep on his 190-acre farm 1,200 feet up on the Durham Pennines. From Mr. Emerson's herd, ponies have gone to Spain, Tripoli and Pakistan, and Mr. Dalton has sent stock to North Africa, Cyprus and Australia.

The Dales Pony Society's secretary, Mr. Peter Lawson, is another enthusiastic pony breeder-cum-farmer. He keeps a couple of Dales mares with his herd of 24 pedigree Ayrshire cattle on his 30 acre-farm at Hutton Gate, near Guisborough in north-east Yorkshire. The ponies live out all the year on some hill land that cannot be reclaimed. They get only supplementary feed in times of heavy snow and frost, and so are almost entirely self-supporting from poor land that could not be used for anything else. Mr. Lawson tells me he can sell foals off these mares at £30 each when six months old, so they certainly make a valuable contribution to the economy of his farm.

West Country

In the West Country, both the Exmoor and the Dartmoor ponies receive their most valuable breeding stock from the upland farms, and here again there is a useful overseas market for the right type of animal. A branch of the Exmoor Pony Society has been formed in Canada, and in the past few years nearly a score have been sent from this country. The Scandinavian countries have also been buying representatives of the breed lately. Dartmoors have been going to the United States, Holland and Scandinavia.

Perhaps the most interesting development has been the extension of these native West Country breeds to other parts of the country. One of the leading herds of Exmoors is that kept by Mr. P. Dean at Brampton, on the borders of Cumberland and Northumberland, and at the 1962 Royal Show it was noticeable that a number of exhibitors were from the North of England and the Scottish borders.

Shetland

Even more widespread is the Shetland, smallest of the British native breeds, and the fact that these hardy little ponies seem able to live on mountain and hill slopes which neither the Fell nor the Dales finds congenial makes it one

of the most profitable breeds of all so far as the upland farmer is concerned. Here, again, there is not only a big home demand for good stock, but large numbers have recently gone to Holland and Scandinavia.

The current popularity of riding among young people has meant that the pony has taken the place of the heavy horse and even, in many places, the hunter. For those farmer-breeders who have suitable hill land available, it is providing a profitable sideline.

The Ministry's Publications

Since the list published in the April, 1963, issue of *Agriculture* (p. 186) the following publications have been issued.

LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Government Buildings, Block C, Tolcarne Drive, Pinner, Middlesex. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (by post 6d.)

ADVISORY LEAFLETS

No. 83. Swine Fever (Revised)
No. 168. Pullorum Disease (Revised)
No. 273. Gooseberry Powdery Mildew (Revised)

OTHER PUBLICATIONS

British Species of *Dysaphis* Börner (New) 70*s.* (by post 71*s.* 6*d.*) Part II. The Subgenus *Dysaphis* Sensu stricto. By H. L. G. Stroyan, M.A. The second part of a revision which includes an explanation of the change of generic name and other developments since the publication of Part I in 1957.

Breeding More Pigs from the same number of sows

F. John Fullbrook

THE profitability of a pig enterprise, other than a purely fattening unit, depends very largely on the number and weight of pigs weaned per sow. These profitability factors are determined by a combination of inheritance and environment.

The more important aspects of environment or husbandry are well understood by pig farmers although, as in most farming enterprises, there are still many problems which call for further research. These environmental factors include the feeding and management of boars and pregnant sows, feeding the nursing sow and creep feeding the piglets. Pigmanship at the time of farrowing and good farrowing quarters, with guard rails and artificial heat to induce the piglets to keep away from the dangers of being overlaid by the sow, come under the same heading. What is not so well known is the relative part which inheritance plays and how it can be used in formulating breeding systems.

Heritability estimates

When discussing the relative importance of the inheritance of any one character, geneticists use the term 'heritability estimate'. This is defined as the proportion of observed variance which is genetic in origin. Some characters—blood groups, for example—are one hundred per cent heritable because environment has no effect on them at all and the blood groups of an offspring depend entirely on the blood groups of its parents. Other characters, a pig's earmarks, for example, have a 0 per cent heritability because they are made by the pigman and are thus entirely environmental. Most important characters in pigs have heritabilities in between these

extremes. In general, carcass qualities are fairly highly heritable—of the order of 40–60 per cent. Rate of daily gain and efficiency of food conversion are a little lower, but still relatively high. Unfortunately all the characters which go to making good litter size and weight, such as prolificacy, birth weight, and mothering ability, are of low heritability—mostly between 10 and 20 per cent.

The heritability of a character indicates two things to the would-be improver. First, it tells him the best selection technique, and secondly the rate of improvement which is possible. When characters are highly heritable, selection of the individual which performs well is the quickest method of improvement. Progeny testing and family selection are used for characters of moderate to low heritability and for characters measurable in only one sex—for example, milk yield.

When the heritability of a character is known, it is possible to calculate the improvement that can be made, on average, in each generation. Taking birth weight as an example, suppose under a particular set of environmental circumstances the average birth weight of gilts on a farm was 3½ lb, and only those weighing 4 lb at birth were kept for breeding. If the heritability estimate for birth weight is 10 per cent then only one-tenth of this difference of half a pound is inherited, i.e., one-twentieth of a pound, and the other nineteen-twentieths are due to environment and are not passed on from parent to offspring. Because half the inheritance comes from each parent, one would expect that selecting these heavier gilts would give rise to an improvement of one-fortieth of a pound per generation if the gilts were mated to average boars.

Material characters

Prolificacy is of low heritability in livestock of all kinds. This is not surprising, because natural selection has favoured the more prolific lines since any species evolved. Infertile lines in all classes of stock have through the ages failed to survive, whereas the very fertile ones have produced more progeny to spread through the population.

Prolificacy and mothering ability within breeds of pigs have heritabilities of around 10 per cent and birth weight, litter weight at three weeks, litter weight at eight weeks, have heritabilities of about 15 per cent. These figures indicate to the geneticist that the selection of gilts from sows that are better than average for these characters will have very little effect on the subsequent performance of the herd. Similarly, the selection of sows that have given heavy litters will not increase the average litter weight appreciably.

The foregoing is perhaps rather a roundabout way of saying that, while farmers will continue to select from the best litters, modern genetic thinking casts grave doubts on the efficacy of this long-established principle to produce more than a very slow improvement.

When, as in the case of all the maternal characteristics of sows, individual selection is ineffective, family selection may be used. To the pedigree breeder the word 'family' usually implies a 'female line', including distant ancestors. Used by the geneticists, it means either the produce of a particular sire, as in the progeny test, or brothers and sisters known as the sib test. If all the daughters of one boar, i.e., half sisters, are better as a group than daughters of another boar, there is a genetic basis for preferring that boar and his progeny.

Breeding systems

Reference was made earlier to the use of a knowledge of inheritance in formulating breeding systems. These include inbreeding, crossing inbred lines, cross-breeding, etc. It is true of all species that inbreeding usually causes a decline in fertility and mothering qualities.

Long-term experimental work at the Animal Breeding and Research Organisation at Edinburgh has shown a serious and progressive decline in the number of pigs per litter at eight weeks with an increasing degree of inbreeding. After several generations of inbreeding, litter size at eight weeks is on average nearly halved. However, when several of these inbred lines are mated with each other (that is, the crossing of three or four inbred lines), spectacular improvements have resulted. Nearly an extra pig and a half per litter have been produced compared with, not the inbreds, but the pure-bred controls.

This technique of crossing inbred lines has long been the tool of the plant breeder. In the U.S.A. the crossing of slightly inbred lines has been used to produce new breeds of pigs that are claimed to be better than the parental strains.

The advantages of line crossing are that it may provide the means of achieving a higher level of performance not obtainable in other ways, and with a particularly good cross it is possible to reproduce this cross without risk of the merit of the cross changing over the years.

The disadvantages are the cost of the initial inbreeding programme, the cost of maintaining the inbred lines finally chosen to produce the line-cross and the time required for the programme. Also it is difficult to keep up with rapid changes in market requirements unless spare lines are maintained in anticipation of such changes.

Work at Edinburgh will have to continue for some time before it is known if the system has any application in practical breeding.

No such reservations need be made when discussing cross-breeding, which can be looked upon as a less intensive method of obtaining hybrid vigour than line crossing. Because inbreeding produces such a marked decline in maternal characters, it is not surprising that cross-breeding shows an improvement in the same characters. In general, crossing two breeds brings about an improvement in litter weight, but the greatest improvement comes from the use of cross-bred mothers. On average, when using large numbers, a cross-bred sow will produce an extra three-quarters of a pig per litter more than a pure-bred sow and an extra 30 lb or so in litter weight at eight weeks.

Evidence from abroad suggests that a still greater improvement can be obtained by introducing a third breed to serve the cross-bred sow. This increase can be as high as 15–25 per cent in numbers weaned and total litter weight. To obtain this further improvement, it is essential that the third breed should have an inherently high litter size.

Selection for cross-breeding

Whilst it is true that the more characters selected for, the less will be the selection pressure on any one character, there are considerations other than litter size and weight in some pig enterprises. Conversion rate is important to all fattening units, and suitability to market requirements is particularly important for those catering for the Wiltshire trade.

Selection of breeds for crossing will depend both on the husbandry system and on the market it is intended to supply.

With an intensive indoor system of sow housing and where carcass quality is of paramount importance, a pig producer may decide that there are only two breeds which meet his requirements. In this case he can take advantage of the improvement obtainable with cross-breeding by first using a cross-bred sow and then by adopting a policy of criss-crossing, changing the breed of boar between the two breeds selected each generation. This enables him to hold a genetic type between the first and second cross.

With an outside farrowing system and with a pork or heavy hog market, one of the breeds may well be a coloured one, and advantage can then be taken of the improvement obtainable by bringing in a third breed.

The practical question that arises is how should a farmer select his pure-breds for crossing. This depends on the relative importance of maternal characters and carcass qualities in his enterprise. He may choose to select for mothering qualities in one of his breeds and carcass qualities in the other, or he may select for each character in both parental breeds.

In order to combine the big improvement which can be obtained by hybrid vigour and also the relatively small improvement obtainable by family selection for maternal qualities, he can employ family selection within each of the pure breeds on the performance of their cross-bred offspring. For example, if a group of cross-bred gilts by one boar produced above-average litters, this boar would be used not only to breed more cross-bred gilts, but also to propagate the pure-bred section.

This type of breeding plan requiring two or three breeds to maintain the cross-bred herd would entail a very large pig unit. On the other hand, the commercial pig farmer using cross-bred sows could select them from good family groups in the breeder's herd. Co-operation could continue if the commercial pig farmer supplied the pedigree breeders with information on the performance of the cross-bred animals. The pedigree breeders could base their own selection programme on this information.

F. John Fullbrook, B.Sc., N.D.D., is Regional Livestock Husbandry Officer in the South-Eastern region of the N.A.A.S. and is stationed at Reading.

4. West Brecon

W. G. Owen

WITHIN its arbitrary boundaries, the West District of Breconshire contains tremendous variety in several aspects. It is bounded on the north by the peaceful Eppynt Mountains and on the south by a hive of human activity marking the fringe of industrial South Wales. To the west is a fairly narrow access to West Wales along the A40 road. The eastern boundary is not well marked and gradually merges into the ever-widening valley of the Usk.

The heart of the district is centred on the river Usk and its tributaries, the soil being derived from the old red sandstone supporting a rich stock-farming community. The farms here are larger than is usual in Wales, over half having more than 100 acres of crops and grass. The chief enterprises are single-suckled beef herds and sheep, and contrary to the more usual pattern, on only one in five of the holdings is dairy farming the main concern.

There are two outstanding features of husbandry in this area. The first of these is the prevalence of swede growing. At one time swede growing was threatened with extinction due to labour shortage, but the crop was saved in Breconshire by a widespread adoption of the technique of precision drilling. Though the acreage grown is not great, it plays a big part in the successful feeding of both sheep and cattle. Indeed, root feeding is associated closely with the other feature of the Usk valley, this being the pride which is taken in sheep and cattle breeding. Most farms have a stake in pedigree breeding either sheep or cattle, and very often both.

Pedigree breeding of Hereford cattle is particularly well represented, with a renown which has spread not only throughout Breconshire but often far outside the county boundary and even overseas. The local class at the Sennybridge and Brecon Agricultural shows is of a very high standard and keenly contested.

Pedigree sheep breeding, on the other hand, is much more varied, with several pedigree flocks of Clun and Welsh. There are also flocks of Suffolks, Radnors and the Beulah speckled-face sheep. An interesting feature of many flocks is the presence of Cheviot blood. Cheviot sheep were brought to the district in the early nineteenth century by Scottish farmers, who exerted considerable influence on the agriculture of their new locality. The largest of these hill flocks, after some infusion of Welsh blood, is now almost pure Cheviot. Further south there are hardy Welsh sheep, becoming more typical of the Glamorgan Welsh the further south we go.

In terms of output, this part of the district has contributed substantially to the success of the suckled calf trade. Calves from the district are found at the suckled calf sales in Builth, Brecon and Sennybridge, and those

entered are carefully scrutinized to ensure a good quality for the buyers. Single-suckled calves, well managed, still provide a reasonable income and entries at the sales continue to increase.

Sheep also make a substantial contribution to the output of the farming community and, in addition to fat lamb production, there are many farmers who draw on draft hill ewes to produce the Welsh Half Bred. These contribute to the success of the Annual Welsh Half Bred sale at Builth, and there is constant effort to improve the quality and evenness of stock entered for the sale.

As we move away from the main valley of the Usk, so we come to the problem area of the district. A formidable problem is that of the common land, one quarter of the total area of Breconshire being classed as common. The west shares this problem with the other districts in the county. In the north there are 2,835 acres of the Mynydd Eppynt common in the Brecon rural district and in the south the vast common land of the Brecon Beacons. Rights of common grazing prevent full use of the land by any section of the community.

On the south side of the Beacons is the most surprising part of the district. Centred on a series of narrow valleys, with outcrops of limestone and generally poor soils overlying coal measures, there are farming communities striving for a living with all the physical forces of nature against them. The rainfall can be anything from 70 to 90 inches a year; the soil can be exceedingly acid and hungry and the farm size and structure very small and extremely fragmented. In addition to these difficulties is the present moderately-prosperous industrial life pushing inwards on either side as if taunting the very existence of agriculture.

However, the industrial surroundings do provide compensation in the form of subsidiary or alternative employment to those whose income from farming is not enough to provide a decent standard of living. The main farming enterprises here revolve around small dairy herds and small flocks of upland ewes. No clash between enterprises could be so disastrous. Sheep and the dairy cow compete for scarce resources, the result being a high cost dairy enterprise. With the poor fodder which is made in the unfavourable climate, the cost of producing milk is prohibitive by any standards. Yet the amazing thing is that the farmers themselves show extreme vitality and a confidence which seems unjustified to the outsider looking on. Perhaps it is their South Walian blood which is responsible for such cheerfulness in the face of difficulties. Somehow, south of the Beacons there is a far more marked feeling of being in South Wales.

Any account of the district would be incomplete without a mention of forestry, which employs approximately 200 people. There are 17,000 acres of forestry in the area, of which 4,700 acres have been planted in the last ten years. Foresters, like agriculturists, are affected and concerned by the problem of common land. The existence of common land, together with the prohibitive price of other agricultural land, has prevented a greater spread of forests in the district.

Such then is West Brecon, full of sharp contrast and surprises as one moves across from north to south. From the keen, clean mountain air on the Eppynt, through the rich, sweet atmosphere of the Usk Valley and on eventually to the industrial humid atmosphere in the south. On this route there are many changes in the nature of soil, men and human activity.

E. N. KAY
Agricultural Land Service, Northampton

View of feed shed, looking up the slope

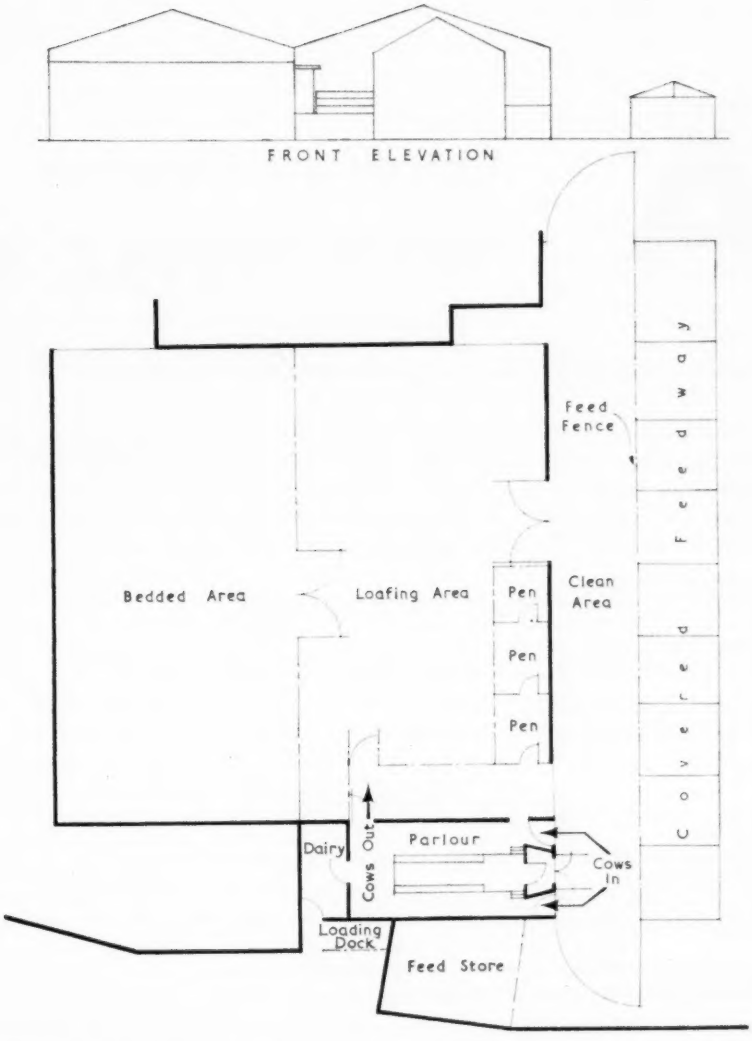
Seventy-two Cows - One Man

MILKING in three separate buildings! What a life—to say nothing of the consequential high labour cost in milking and tending the herd! What the farmer concerned wanted was a building layout for 72 cows, so that one man with part-time help for cleaning could do the work being done by three men. The Agricultural Land Service was asked to advise.

A suitable site was available between a traditional stone barn and the village street. Some old dilapidated hovels facing a large open yard were demolished, so giving a bare area of sloping ground upon which two linked clear span structures 90 ft by 83 ft overall were erected. These contain fully covered lying and loafing areas for the cows, four calving boxes adjoining the parlour and a row of single calf kennels for very young calves.

A feature of the layout is a separate feeding shed parallel to the yards and separated from them by a 15 ft wide concrete strip which serves as the feeding and collecting area. The feed shed of timber and asbestos is 120 ft long, with a 15 ft span. It can hold two weeks' hay requirement and still leave room for a tractor/trailer drive-through for carting silage, kale, etc., to the herd. If zero grazing is adopted in the future the shed will meet the new requirements.

The cows feed through vertical steel tubes placed at 15-inch centres on the open face of the shed, and a purpose-made gate at the high end of the concreted feed area gives additional manger space. Slurry from the loafing area and the open feeding/collecting area is disposed of mechanically. An efficient blade pushes it down the slope direct to a mechanical spreader for transfer to the fields. This takes only about thirty minutes a day.



Milking is in a six-stall, three-point tandem parlour adjoining the south-west corner of the yard; the dairy unit alongside abuts on to the village street, and churns can be transferred to milk lorries at tailboard height. Circulation cleaning and milking direct to churns linked in series greatly ease the cowman's task.

Concentrates are bought in bulk and are transported by a bucket elevator to hoppers above the parlour stalls.

Good use has been made of the former milking shed area. One side has been converted into a first-class air-conditioned and insulated pig fattening house for 160 pigs, and the parallel shed has been converted into three calf yards, 20 calves in each. The connecting shed and former dairy have been demolished to give access to the central yard area which has been fully covered by a timber-framed silage barn with a 4 ft overhang at both sides; one side forms a feeding passage and manger to the calf yards, and the other forms a dunging passage to one side of the piggery.

Agricultural Chemicals Approval Scheme

Additions to the 1963 List

THE following additional products have been approved under the Agricultural Chemicals Approval Scheme. The Third List of Approved Products was published on 1st February, 1963.

INSECTICIDES

DDT—*Liquid Formulations*
KYP DDT 25—Agricola Plant Protecting Chemicals Ltd.

DDT WITH BHC—*Pastes*
Murphy Combined BHC/DDT Paste—Murphy Chemical Co. Ltd.

KELTHANE—*Liquid Formulations*
Kelthane 20—Pan Britannica Industries Ltd.

FUNGICIDES

MANCOZEB
A dithiocarbamate-type complex for the control of potato blight.
Wettable Powders
Dithane 945—Pan Britannica Industries Ltd.
Dithane 945—Shell Chemical Co. Ltd.

ZINC-ACTIVATED PETD ('POLYRAM')—*Wettable Powders*
Polyram Fungicide—Boots Pure Drug Co. Ltd.

HERBICIDES

DICHLORPROP—*Liquid Formulations*
Croptex Polygon—Crop Protection (Grantham) Ltd.

MECOPROP—*Potassium and Sodium Salt Formulations*
P.B.I. Clover Killer—Pan Britannica Industries Ltd.

MECOPROP WITH FENOPROP—*Potassium Salt Formulations*
Marks Mecofen—A. H. Marks & Co. Ltd.

SEED DRESSINGS

gamma-BHC WITH CAPTAN—*Dry Seed Dressings*
Gammalex—Plant Protection Ltd.

MISCELLANEOUS

WETTERS
P.B.I. Spreader—Pan Britannica Industries Ltd.

IN BRIEF

Hay — If it's Wet

Whilst we hope for a fine haymaking season, we must be prepared for a wet one. On small acreages ventilating fans can be used to blow air around the bales either in the place where they are to be stored ready for feeding, or specially arranged in batches.

The batch method is suitable on small dairy farms. If well heated air is available, the bales of hay can be brought into the drier with as much as 55 per cent of moisture in them. This means that the time the hay is in the field can be short, and it means that the grass can be cut down when it is really nutritious.

The batches should be stacked into the building to no more than 9 feet high. The airflow required for ventilation depends on the floor area covered by the bales, and at the beginning of the drying process as much as 60 cubic feet of air per minute is needed for every square foot of floor area.

At this stage the air is not heated, but as the bales become drier the cold air becomes less effective in removing the moisture from the hay. Therefore, for the next stage, the air is warmed until its temperature is 25° or 30°F above that of the atmosphere, to reduce its relative humidity and thus increase its ability to pick up moisture. At the same time, however, the rate of airflow can be decreased to about 30 cubic feet per minute for each square foot of floor area.

The whole drying process takes a week or less, and at the end of that time the bales can be removed to make room for another batch.

The bales in the batch-drier stand on a false floor made of some such material as welded steel fabric, with a chamber under the false floor, about one foot deep, into which the ventilating air is blown.

The air can be heated by electricity, oil or coal. Some precautions against fire are necessary.

If an internal combustion engine is used to drive the ventilating fan, a slight rise in temperature of the air can be obtained from the waste heat of the engine without any other form of heating. This method can be used to dry batches of bales that have been made at up to 40 per cent moisture content and placed on a portable drying platform in a building, or stacked out of doors in the form of a tunnel covered with a sheet.

Early Potatoes in Paper Sacks

The use of paper sacks for bagging maincrop and pre-packed potatoes is on the increase. Why not for earlies as well?

The trade welcomes these clean, attractive, non-returnable containers, and they have advantages on the farm. They can carry personal advertisement or quality slogans, and can soon build up an image and reputation for good produce on a

specific market. The early new potato is, or should be regarded as, a high-priced, tender vegetable. The type of ½-cwt sack best suited is made of three thicknesses of kraft paper of 33 lb or 37 lb wet strength—size 13 × 8 inches and 33 or 34½ inches long. The shorter sack is a little cheaper, but an extra 1½ inches makes it easier to tie and to handle, and ensures a firmer and more positive seal.

The sacks are tied with wire, using the simple pull-twist tool. Wires of 16 gauge, 10 inches long give the best results.

It is an advantage if any brand design on the face should also be carried on at least one side and, if possible, on the base. This will ensure that identifying marks are showing on a loaded lorry, and will be recognizable on arrival in a market.

Four or five large firms now offer these sacks at prices of less than £25 per 1,000, printed and delivered. Two types are available—those with pasted flat block bottoms, and those with stitched gusset bases. There is no apparent difference in use.

During the picking season the potatoes, graded by hand, are tipped direct from wire picking baskets into the paper sacks distributed down the field. The first basketful in each sack enables it to stand erect, and subsequent filling is done without difficulty. In windy weather it is necessary to weight the supply of empty sacks behind each picker with a stone or clod. Sacks standing in this way on damp ground or in rain come to no harm. Wet sacks loaded on to lorries in heavy rain and carried a hundred miles have had less than 2 per cent of bursts.

Contrary to what may be expected, moist new potatoes do not sweat in sealed paper sacks. They remain firm and cool, and are in perfect condition, even after several days.

The use of paper sacks by the grower may result in lower overheads for the wholesaler, particularly if previously he supplied his own returnable hessian sacks. If such merchants are willing to reduce their commission rates (say by 2½ per cent), in an average year, this would cover the cost of the sacks.

The Potato Marketing Board sponsored the use of paper sacks last season and made them available to producers of early varieties in certain parts of the country. They are doing the same thing again this year.

The Case for Permanent Grass

PROFESSOR M. MCG. COOPER spoke about leys and permanent pastures at the British Grassland Convention. 'There does not appear to be any material difference in productivity between good leys and good permanent pasture', he said, 'provided both are subjected to the right sort of management. It is not that my New Zealand upbringing is unduly influencing my point of view. It simply is that there is no convincing evidence in Britain to show that a permanent pasture, which is dominantly ryegrass and white clover, the climax association of well-managed permanent pasture, is any less productive than a ley over the 3–4 years of its life.

'The wisdom of ley farming in a system of alternate husbandry where cash crops are an economic proposition is not questioned. I am concerned with the doctrinaire view that the plough should be systematically taken around a grassland farm merely to maintain the quality of pastures. By all means plough out poor permanent pasture if methods of surface improvement are unlikely to produce sufficiently rapid results, but otherwise regard the plough as no more than a tool of last resort to cover up mistakes in pasture management, such as poaching, under-grazing and failure to provide sufficient fertility to support high-producing species.

'We must not, in our enthusiasm for grassland farming, forget economic considerations. There is no cheaper nutrient than that from permanent pasture, which has no establishment costs and requires no implements beyond those for fertilizer application and for conservation. Permanent pasture farming can be low cost farming, and it need not be low level farming if intensive methods of management are adopted.

'I am not necessarily advocating 100 per cent permanent grass, because it can be thoroughly sensible for a grassland farm to have a small area of short-term leys to give additional length to the grazing season and to give a little more flexibility in management. What I am questioning is the wisdom of integrating uneconomic cropping into a farm programme where the job of producing straw or grain is best left to someone with the scope and the natural conditions to do this job efficiently.

'Too many of our farmers make their jobs too complicated by attempting to do too many things on relatively small farms which would be best devoted to one main purpose. Where the conditions suggest that this should be grass, one's energies can be very fully harnessed in the growing and utilization of this crop.'

Vaccination against Fowl Pest

Some changes in the recommended vaccination programme for fowl pest have been made. This has been done in the light of experience gained during the past six months of the performance of the vaccine under field conditions, particularly in areas where the incidence of the disease has been high. The revised programme is designed to establish a higher level of immunity in a flock.

The main changes to the previous recommendations, which suggested vaccination at three weeks and at point of lay, are: (1) that chicks may effectively be vaccinated earlier, at fourteen days of age; (2) that in areas of high disease incidence (e.g., Lancashire and East Anglia) an extra injection should be given to growers and laying stock at nine to ten weeks of age; (3) that, in areas of high disease incidence, birds vaccinated for the first time at an age greater than three weeks should preferably be given the second injection about one month after the first dose; and (4) that any birds not recently vaccinated should be given an immediate further dose of vaccine if they are exposed to infection, for example by the outbreak of disease on neighbouring premises.

The Ministry advises all poultry keepers to follow these recommendations. Subsidized vaccine is available to any poultry keeper in England and Wales who wishes to secure such additional protection.

New Director N.A.A.S. Eastern Region

MR. HAROLD BURR, M.SC., has succeeded Mr. John Anderson, who left the Ministry last month to take up an appointment with FAO.

As Deputy Regional Director at Cambridge since 1957, Mr. Burr is, of course, already well known to farmers in East Anglia; but by his many articles and speaking in various parts of the country, he is also known to countless others. He is particularly held in high esteem in Cornwall, where he was County Advisory Officer for nine years.

He is 47 years old and comes of Somerset farming stock. He obtained his B.Sc. degree at Reading University, and for post-graduate research at the National Institute for Research in Dairying, he was awarded his M.Sc. degree.

We wish him every success in his new post.

Books

English Country Life, 1780-1830. E. W. Bovill. Oxford University Press. 30*s*.

In his preface, Mr. Bovill tries to persuade us that he wrote this book 'to present studies of certain aspects of country life which appear to merit closer attention than they have so far received'. But this is no more than a formal obeisance to the academic gods and it deceives nobody. For it is quite obvious that he wrote this book because he wanted to write it.

He has, it appears, recently returned from the historical equivalent of a prolonged and highly enjoyable country holiday in Hanoverian England and naturally wants to tell us all about the interesting things he saw and the interesting people he met. Indeed, the book reads like the conversation of an informed, observant and unsentimental traveller with a gift for the effective phrase. And the material is so engrossing and the style so agreeable that it is some time before you appreciate the weight of reading that lies behind each carefully considered paragraph.

In vivid, personal fashion he tells us about labourers and farmers, squires and lords, about poachers, innkeepers and swell dragsmen; about enclosures, gardening and game laws. He describes the rural misery of the times and reminds us that the author of that elegant classic, *Our Village*, was a contemporary of Captain Swing. He takes us to manor houses and more lordly mansions, and helps us to understand the emphasis in Jane Austen's novels on the varied pastimes with which the ladies whiled away the interminable hours when the men were hunting, shooting or playing billiards. Above all, he traces in detail the creation of the hunting and shooting traditions we know today.

He also finds time to comment on such incidental matters of interest as the planting of elms to produce the timber needed for keels, drainpipes and canal-works, the replacement of pedlars and packmen by the village shops which the new roads of McAdam and Telford made possible, the importance of candle-ends, and, astonishingly, the shortage of domestic servants.

Of course, Mr. Bovill is not infallible. Is there really evidence that 'the fertility of most of the common fields was exhausted'? And even as 'a broad outline' his picture of country life in this period is incomplete. He does not mention, for instance, the rising professional class, typified by the ubiquitous Loudon, who administered the great estates and planned so much of our countryside.

But he has written a very, very good book indeed, so good that, in the traditional words of ultimate praise, 'you would not know you were reading history'. You will enjoy reading it as much as Mr. Bovill evidently enjoyed writing it.

The book is admirably illustrated with some twenty contemporary pictures, including a Morland, a Reynolds and several Rowlandsons.

N.H.

The Lily Year Book, 1963. The Royal Horticultural Society. 12*s*. 6*d*.

Lily growers in many parts of the world have combined to make this year book of outstanding interest. Five colour plates and numerous black and whites enhance it.

The contributors—both from home and overseas—write equally of success and failure. Home contributions show how lilies are being grown successfully over a wider area of the country than was once thought possible.

Lord Elphinstone writes about lilies in his garden on the east coast of Scotland, and several of his observations are of considerable interest. He emphasizes again the necessity for constant propagation to maintain stock of some varieties, including strong growing modern hybrids, of which a number are not proving long-lived in gardens. Other factors that have contributed to his success are generous feeding, and the growing on of seedlings under conditions of good fertility.

Both Dr. J. P. Green's article 'Lilies in a Midland Garden', and D. Parson's 'Lilies at Broxbourne', contain useful advice. Dr. Green discusses his triumphs and misfortunes, from a start with a few bulbs bought in a chain store to his present methods of seed sowing and scale propagation; also his first steps with hybridization.

Mr. Parsons is interested in the commercial production of lily bulbs; his difficulties and disappointments with his earlier consignments of imported bulbs

and his eventual victory will be of interest to all who contemplate buying bulbs from overseas.

Mr. R. Platt develops a theme touched on by the two preceding writers—the longevity or otherwise of some species, and hybrids. That some lilies persist in the garden while others disappear is well known, but the reasons for this behaviour are still undiscovered.

In describing the lilies in the gardens at Quarry Wood (Berks), Mrs. Dee Martyn Simmons writes with great feeling for the originator of the garden, the late W. Bentley, who acquired much of the present collection. Many of the varieties have persisted and increased during the ten years since his death. This must be one of the most extensive private garden collections in the country, and it is good to know it is being increased and carefully tended by the present owners.

The Californian Liliaceae is discussed by E. K. Balls. R. W. Lightly outlines the use made of lilies for conservatory and garden decoration at Longwood Gardens, Pennsylvania, one of the best-known public gardens in the U.S.A.

Other overseas contributors write about lily-growing in South Africa, Australia, Japan and Canada. D. R. Smith, a member of the N.A.A.S. at present working at an American University, contributes a further paper on the forcing of *L. longiflorum*.

H.J.E.

Portrait of Peakland. CRICHTON PORTEOUS. Robert Hale. 18*s*.

Portrait of Peakland is the latest in a new series of books about well-known rural areas. It is a captivating book, packed with interesting facts which quickly give the reader the 'feel' of Peakland.

Crichton Porteous writes lucidly, yet with a discursiveness that belies any suggestion of pedantry. A true countryman, with a deep love of his surroundings, he has the ability to project the character of his people and places into the mind of his reader. He sets out successfully to advise both walker and motorist on the best way to see the High Peak country, and he does so from a really intimate knowledge of the district's highways and by-ways.

I particularly enjoyed the descriptive chapters on quarrying and stone-dressing, and on lead mining, both ancient crafts which are still carried on in north-west Derbyshire.

The book could have been improved by a similar chapter on the historical development of agriculture in the area, and a note on the dialect of Peakland would have added value.

An author obviously cannot find space for everything, but there are occasions in the text where a fuller description would both be useful to the visitor and do greater justice to the subject. For example, the brief note on the 'Cathedral of the Peak' at Tideswell contains no mention of its famed contemporary wood carvings.

But these are minor criticisms. *Portrait of Peakland* will whet the appetite of the visitor or holidaymaker, and send him in search of the history and beauty with which Peakland is so richly blessed. Indeed, even the resident, perhaps already with a good library on Derbyshire, will be well advised to add this book to his collection.

It is richly enhanced by the number and quality of its photographs. In black and white, they capture and present something of the inherent fascination of Peakland which those who know it love so well.

L.M.W.

Lessons from Food and Weight Recording in Beef Production. R. BENNETT JONES. University of Nottingham. 4*s*.

During the last few years several beef weight recording schemes have been started by breed societies and by other bodies. Those sponsored by breed societies are presumably chiefly concerned with breeding aspects, and the others chiefly with management problems.

The scheme run by the Lincoln Red Society is of particular interest because not only does it combine breeding and management aspects but, in a sample of the herds, food consumption as well as weight has been recorded.

The results from ten breeders, who weighed both food and cattle during the winter of 1961–62, have been analysed by the Economics Department of the University of Nottingham School of Agriculture. Only 174 cattle were involved, but this was sufficient to indicate the type of useful information which can come out of a scheme of this sort.

An attempt was made to answer three questions:

(1) Are my cattle profitable?
(2) Can my cattle be made more profitable? and
(3) Should my cattle enterprise be enlarged or contracted?

In spite of the small number of herds and the great differences between them, and in spite of the resulting corrections, allowances and estimates which had to be made, it was possible to answer a categorical 'Yes!' to the first two questions. Although the cattle showed a gross profit per animal, in several cases the profits could have been improved by feeding a cheaper concentrate mixture or by fattening the cattle at a younger age, particularly by fattening them in yards instead of turning them out to grass in the spring. Furthermore, on four out of the five farms on which the margin per acre could be calculated, this was found to be very unsatisfactory. This result is related to the answer to question (3).

On at least three of the farms in the sample, it was decided that the cattle enterprise ought to be contracted because of the intrinsically greater profitability of cropping in the East Midlands under the present conditions. I think it should be pointed out, however, that these were pedigree farms rather than purely fattening farms, so that part of the return would come in the form of pedigree advantage.

In view of the obvious danger that beef recording may be used as a gimmick in order to sell bulls, it is reassuring to find that the first results of the recording scheme of a breed society should be put to the most practical use as demonstrated by the present bulletin. *I.L.M.*

Pig Keeping. W. D. PECK. Faber and Faber. 30*s*.

The title suggests that this book has been produced with a view to giving information to the man who actually keeps pigs. Therefore, the way in which it is written, the presentation, and the phraseology, must be such that it can be easily read and interpreted by pigmen.

Fortunately, this is most certainly the case. The book is in a most readable form and the contents are arranged in a manner which makes it easy to assimilate. The author has very wisely confined himself to discussion, and to the practical application of well-established fundamentals.

The pig industry today is, unfortunately, composed of widely differing standards in terms of efficiency of production. Those who are in the bottom half of the management category (some of whom are achieving a loss) can effect a considerable improvement in their profitability simply by the application of well-established fundamentals.

As feeding plays such an important part in the profitability of any pig enterprise, it is wise to have given this subject complete coverage; three chapters are devoted to it.

It is possible to be critical of one or two details, such as the suggested substitutions for 1 lb of fish meal, and the inference that earth nut meal is equally as good as Soya bean, as well as a lack of relationship between the amount of meal used and the conversion figures suggested in Appendix 8. But it must be acknowledged that, overall, the book provides any pig keeper, whether on a large or small scale, with a wealth of reliable information.

Considerable use is made of tables drawn from various sources as a means of substantiating the statements referring to management. The chapter on Housing, together with the plans in the Appendix, should give those intending to modify existing buildings or to build new ones something to think about.

Any references to costs are unavoidably soon out of date, but nevertheless the profitability figures referred to in the chapter entitled 'Copper or Gold' are such that I feel that the relative positions will remain true for quite a while, even if the actual figures differ. *J.R.L.*

***Farm Mechanization* Directory, 9th Edition.** Temple Press Books. 42*s*.

The format of the *Farm Mechanization* Directory is basically similar to the previous edition; it would, indeed, have been a pity to make major changes to a layout which has become familiar to many people.

The Directory is divided into four parts. Except for revision to bring the information up to date, Part I is unchanged and includes an almost complete list of names and addresses of manufacturers of farm equipment. A separate list enables trade names, brands and abbreviations easily to be traced. In addition, there are brief details of organizations concerned with farm mechanization.

All the information relating to tractors is now contained in Part II. It is in two sections. The first, which would have been improved by an index, provides detailed specifications of tractors. The second section consists of alphabetical lists of available B.S. and N.I.A.E. tractor test reports; the full reports which appeared in the previous edition have been omitted.

The third part is an index to the main section of the fourth and largest portion, consisting of over 200 pages. In this, implements and equipment are classified under

carefully chosen headings, so that it is possible for the reader easily to find the manufacturers, and in many cases details, of any piece of equipment. There is also a list of the implements which have been approved or recommended by tractor manufacturers for use with the specific make of tractor.

Finally, an alphabetical list of N.I.A.E. implement test reports is provided, but the corresponding list for N.I.R.D. Dairy Machinery has been discontinued.

Information is presented clearly throughout and the many photographs are generally helpful. In a book containing as much information as this, a few errors, some of which may be detected only during use, are perhaps inevitable. However, the *Farm Mechanization* staff are to be congratulated on maintaining the standard of accuracy of previous editions. *G.P.S.*

The Rhododendron and Camellia Year Book, 1963. The Royal Horticultural Society. 12*s.* 6*d.*

The 1963 edition of the *Rhododendron and Camellia Year Book* fully maintains the high standard that we have come to expect from the Royal Horticultural Society's publication. The coloured frontispiece of the Kurume Punchbowl in the Great Park at Windsor warms the heart in the depth of winter and illustrates what magnificent possibilities lie before the fortunate possessors of acid soil.

Rhododendron enthusiasts the world over obtain much pleasure from the foliage characteristics of the species and hybrids, and indeed some of these are such superb plants that even if they never flowered they would be worth a place in a large garden. A section on the foliage of rhododendrons by Mr. T. H. Findlay makes fascinating reading.

This is essentially a book for the expert and Mr. H. H. Davidian's contribution, continuing his revision of the rhododendron genus, will be of the utmost interest to the keen specialist.

This Year Book, unlike any other publication that we have come across at home or abroad, is truly international in flavour, and articles about rhododendrons and camellias from many parts of the world keep British growers abreast of developments.

The camellia is, of course, being widely planted, and during the recent bitter weather has proved again how hardy it is. The section dealing with camellias will be of interest, not only to the specialist, but to all who have the room to plant these lovely shrubs and the patience to see them come to maturity. *R.H.*

Livestock Nutrition. The Graham Cherry Organisation.

It is not often that British farmers and feed merchants have the opportunity to hear top-rate U.S. experts in the fields of pig, poultry and beef cattle nutrition. For this reason, four conferences, held in London and the provinces, during the period of the Feed Show at the U.S. Trade Center in London (20th March—10th April, 1962) were most valuable. As Sir John Hammond states in the foreword of *Livestock Nutrition*, which is a report of these conferences, the cost and proper utilization of feedingstuffs are all-important to British livestock producers.

So Dr. O. B. Ross's (Illinois) paper on Intensive Beef Production Practices in the U.S. was most timely. The sequel to this was a statement by Dr. G. E. Lamming, who assessed the place of U.S. practices in Britain. He thought there would be a wider use of high energy foods, and that cattle would be slaughtered at an earlier age at lighter weights. Pure Friesian and Hereford crosses would be the chief sources of beef. He foresaw four main systems—mainly concentrate feeding in the eastern grain counties; silage and hay with some concentrates for central England; the traditional grass fattening areas, and winter beef using by-products of the arable rotation.

'Pig Nutrition Research in Iowa' was the title of Dr. V. C. Speer's paper. He referred to his university's work on the nutrition of early weaned pigs, the importance of the calcium and phosphorus requirements, the value of copper in the diet, and the protein/energy relationships as they affect quality of bacon carcass. In the discussion, Dr. Braude (N.I.R.D.) sounded a note of caution when he said British pigs, their diet and standards of carcass quality, were different from the U.S.

The fashionable research field of rumen micro-organisms, and their relation to ruminant feed conversion, was dealt with by Mr. J. C. Shaw, late of Maryland and now at FAO, Rome.

Professor E. L. Stephenson (Arkansas) outlined the U.S. views on the proteins and amino acids in poultry nutrition. This was a highly technical paper, but it illustrated very well the immense amount of

basic work that had been done before the modern broiler chicken could have been purchased.

The U.S. Agricultural Attaché is to be congratulated for organizing this series of conferences so well. The report can be obtained free from the Graham Cherry Organisation, Ltd., 41 Parliament Street, Westminster, S.W.1.

H.E.

The Farm: Young Farmers' Club Booklet No. 1. Evans Bros. 3*s*.

First of the popular Young Farmers' Club series, this useful booklet has been reprinted with suitable amendments to bring it into line with present-day farming practice.

It claims to provide 'notes for those who want to learn the rudiments of farming and for teachers who intend to introduce into their schools work that will encourage an interest in the farm's life and surroundings'. It also 'endeavours to act as a stimulant to further enquiry'.

The booklet realizes these aims very well indeed and gives simple, understandable explanations of facts about soils, plants and animals. It asks the very questions that are so often in our minds and yet are not answered convincingly anywhere else. In this question-and-answer method lies its success. It is a book that can be understood and enjoyed by boys and girls, and can equally well provide a good deal of information for adults.

At the end of each chapter there are suggestions for further work, mainly practical and well within the scope of its readers. A list of useful books and periodicals on the various aspects of farming is given at the back of the book.

It is regrettable that the illustrations should look so old-fashioned—those on pages 15 and 46 are examples—when good up-to-date farming photographs are so easy to obtain. The illustration on page 26 shows a cow drinking from a pond or stream, which is something to be discouraged under a good system of management. These points, however, are but minor blemishes on a most worthwhile little booklet.

J.A.S.

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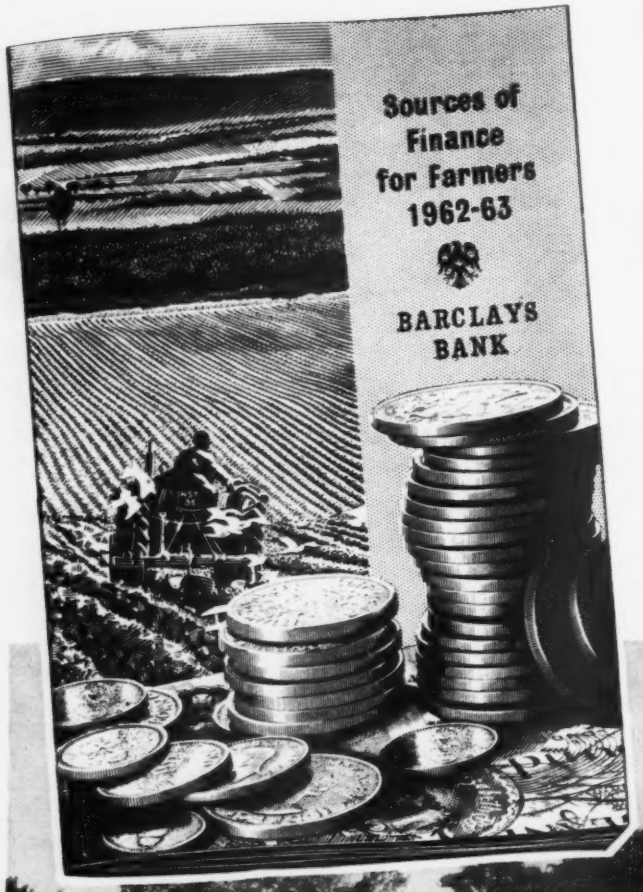

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